BOOKS BY ALLAN NEVINS

FORD: THE TIMES, THE MAN, THE COMPANY

STUDY IN POWER: JOHN D. ROCKEFELLER, INDUSTRIALIST AND PHILANTHROPIST

THE DIARY OF JOHN QUINCY ADAMS *(edited by Allan Nevins)*

THE EMERGENCE OF LINCOLN, 2 *vols.*

ORDEAL OF THE UNION, 2 *vols.*

A CENTURY OF CARTOONS *(in collaboration with Frank Weitenkampf)*

THIS IS ENGLAND TODAY

JOHN D. ROCKEFELLER, 2 *vols.*

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FORD:
THE TIMES
THE MAN
THE COMPANY

FORD

The Times, the Man
the Company

BY ALLAN NEVINS

WITH THE COLLABORATION OF FRANK ERNEST HILL

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PREFACE

"It is doubtful if any mechanical invention in the history of the world has influenced in the same length of time the lives of so many people in an important way as the motor car." So writes an American historian, thinking of the automobile alone.* But it does not stand alone. For it was the automobile factory which introduced mass production, in its full scope and meaning, to the world; and mass production has changed the lineaments of our economic and social life more profoundly than any other single element in the recent history of civilization. Everyone knows something of this transformation; few have any detailed or exact knowledge of its inception and development. The history of the automotive industry, and of mass production, alike remain to be written. In both these histories the record of the Ford Motor Company is of no inconsiderable importance.

This volume is the product of a grant from the Ford Motor Company Fund to Columbia University in the interests of general business history. The book has been written under the auspices of Columbia University, in its offices, and with the advice of a special University committee; the research has been done by University employees, working under ordinary academic conditions and with the usual academic salaries; all royalties on the volume are paid to the University. For the contents of the book, however, Columbia University has no responsibility whatever. It has merely guaranteed the independence and disinterestedness of those engaged on the task, and facilitated their labors. For all the faults and shortcomings of the history, the author alone is responsible.

While this is primarily a history of the Ford Motor Company in the period of its spectacular rise—a story which for drama and color assuredly has few equals in our economic annals—it is also, as the title suggests, in some degree a history of the automotive industry in gen-

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*H. U. Faulkner, *The Quest for Social Justice* (New York, 1931), 137.

eral, and to some extent a biography of Henry Ford. These three elements are of necessity inextricably intertwined. No understanding of the origin and growth of the Ford Motor Company is possible without some knowledge of the work of Lenoir, Otto, Marcus, Benz, Daimler, Levassor, the Duryeas, Olds, Haynes, Winton, and others, and some attention to the rise of rival companies. The story of the Selden Patent must be told with some fullness. A large biographical element also could not be excluded. Two men, James Couzens and Henry Ford, were indispensable to the early success of the Ford Motor Company. It would be fair to say that the contribution of Couzens in these years was almost as important as that of Ford; but it should also be said that though the country had a good many men of the talents and training of Couzens, it had only one Henry Ford.

A book of the scope and complexity of this volume cannot, in a broad sense, be produced by one man. In research, the resources of the Ford Archives at Dearborn and the unwearied cooperation of its staff have been invaluable. These archives, as administered by A. K. Mills and Henry Edmunds, furnish a model for any industrial organization which wishes to preserve its records and make them available to students. A vital part of the Archives is the Oral History section administered by Owen Bombard, who was trained in the Oral History Research Office of Columbia University, and who has already collected an imposing array of personal recollections by key figures in the automotive industry. Much of this material is pure gold for the historian. Readers of this volume will note how often these recollections have imparted life and meaning to the skeletal materials furnished by correspondence and account books. In the course of his work Mr. Bombard has acquired a broad and detailed knowledge of Henry Ford and the Ford Motor Company, and his constructive criticism has furnished a valuable supplement to the materials gathered under his supervision.

Other members of the Archives staff—Richard Ruddell, Stanley Graham, Wyn Sears, Keith Clark, and Madeleine Felix—have given unselfishly of their time and their special knowledge.

Special thanks are due to William Greenleaf and George B. Heliker, who as research assistants have labored on this project from the beginning, and who by their understanding, accuracy, and constructive suggestions have contributed to the book. Useful assistance has also been given from time to time by others, notably James Shenton, Gordon

W. Davidson, Jeannette Mirsky, and Mrs. Jean Conti. The members of the advisory committee appointed by Columbia University have lent general counsel: Dr. John Krout, Provost and Vice-President of the University, Dean Harry Carman, Dean James K. Finch, and Professors Leo Wolman, Harry W. Jones and Benjamin H. Beckhart. At the Detroit Public Library much useful assistance has been provided by Mrs. Elleine H. Stones, Chief of the Burton Historical Collection; Mr. Robert E. Runser, Chief of the Technology Department; Miss Helene Thorpe, Chief of the Social Sciences Division; and Miss Maude Payne of the Automotive History Collection. Information about Siegfried Marcus was furnished by Dr. Josef Nagler, Director of the Technical Museum for Trade and Industry in Vienna, Austria. Among others who have given their aid are Mr. Chester M. Culver, Executive Vice-President of the Employers' Association of Detroit; Mr. Frank X. Martel, President of the Detroit Federation of Labor; Dr. F. C. Bald of the Michigan Historical Collections at the University of Michigan; Dr. Alfred G. Harris of the Labadie Collection of the University of Michigan; Frederic R. Coudert; Charles E. King; Grace E. Parker; Wilfred C. Leland; Ralzemond D. Parker; and Oliver E. Barthel.

ALLAN NEVINS

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CONTENTS

Preface vii

I. *THE ROAD: THE WHEEL* 1

Conquest of distance a crucial activity in American history. Primitive beginnings with trails and rude roads; packhorse travel; highways; the Concord and Conestoga, and the craft of the carriage maker. Appearance of the railroad: its special advantages (and abuses) in America. Its disastrous effect upon the growth of roads for horse-drawn vehicles: penalties paid by Americans not near the railroad. Improved roads and vehicles a necessity for national development, with the modern highway and the automobile providing a solution.

II. *THE PIONEERS* 20

Pioneers in automotive transportation: the Duryeas, Haynes, Olds, Winton. Birth of Henry Ford near Dearborn, Michigan, during the American Civil War. His father's family in Ireland: the first Fords arrive in America in 1832; frontier character of Michigan territory. Brief record of the Nowlins, a typical settler family in the area; the Fords' experience. Arrival of John Ford, Henry's grandfather, 1847; influence of pioneer environment on Ford descendants.

III. *THE CHILDHOOD OF AN INDUSTRIALIST* 36

Beginnings of the machine age in the Middle West; industrial activity of Detroit. Effect upon Henry Ford, paralleled by experience of other automotive inventors. William Ford assists his father, and later works with Patrick O'Hern. Mary Litogot (O'Hern) and her marriage to William; her Dutch or Belgian ancestry. William's acquisition of extensive farm holdings. Henry the first child; his earliest recollections; his brothers and sisters. Scotch Settlement School: character of pupils and teaching; Henry's mechanical experiments there. Influence of Mary Ford on her son; her death in 1876.

IV. *YOUTH AND THE MACHINES* 54

Young Ford's encounter with a portable steam engine; its influence upon him. Background of the development of steam power, particularly as applied to "road carriages." Henry's interest in watches and skill in repairing them. His father's visit to the Centennial Exposition of 1876 and its probable effect upon his son. Gas engines: their origin and development through Lebon, Brown, Barnett, Perry, Drake and others; Lenoir's successful model of 1860 and the Otto & Langen engine (1867). George Brayton's work in America; the "silent Otto." Henry Ford's determination to leave the farm; his father's attitude; departure for Detroit late in 1879.

V. *A PERSISTENT APPRENTICE* 74

Character of Detroit in 1879: manufactures, shops, railroads; original plan

of town and maintenance of its "garden" character. Ford's brief stay at the Michigan Car Company; his discharge and employment by the Flower brothers; his work repairing watches to supplement income. *Shift* to Detroit Drydock Company: its character, and influence of Frank Kirby; most of Ford's apprenticeship served here. *Departure* from Detroit, 1882; work as operator of stationary steam engines and Westinghouse Engine Co. expert. Letters from friends in this period; attendance at business college in Detroit.

VI. *THE BROADENING STREAM* 92

Early activities of men later to become automotive pioneers. Developments in the field of "road carriages": steam, gas, and gasoline. *The "silent Otto,"* an engine using the *four-cycle* theory enunciated by Beau de Rochas. Siegfried Marcus: his two carriages in Vienna, 1864 and 1875. George B. Selden of Rochester, N. Y., and his application for a road carriage patent. Daimler and Benz in *Germany*: Daimler's revolutionary high-speed engine. Henry Ford and Clara Bryant: courtship, and her faith in his mechanical genius. Their marriage and settlement on a farm provided by William Ford; Henry as operator of a sawmill. His repair work on engines in Detroit and elsewhere. A plan for a horseless carriage and the decision to move to Detroit.

VII. *THE EVE OF REVOLUTION* 119

The Edison Illuminating Company and Henry Ford's post as night *engineer*. Growth *and* character of Detroit as industrial center; opportunities there for Ford. Continuation in Germany of the work of Daimler and Benz: Daimler's motorcycle, motorboat and four-wheeled gasoline carriage; Benz's tricycle. Development of these vehicles in Germany and particularly in France by Panhard & Levassor and Roger. American automotive workers: the Duryeas (first successful American gasoline automobile), Ransom Olds, Elwood Haynes, Hiram Percy Maxim. *First races* for power-driven carriages: in France, 1894, 1895; in the United States at Chicago, 1895. Frank Duryea's victory and its effect upon American activity.

VIII. *A HORSELESS CARRIAGE* 142

Henry Ford's *first* successful experiment with a small engine, Christmas Eve, 1893. His acquaintance with Charles B. King and the latter's engines and projected motor carriage. King's first demonstration of a horseless carriage in Detroit, *March*, 1896. Ford's experiments while chief engineer of the Edison company; his "quadricycle": *its* character; assistance of King, Barthel, Cato, Bishop, Huff. First run of the car, June 4, 1896; its *rebuilding*. Trial runs to *Greenfield*, Dearborn, Belle Isle. Performances of other American machines: Duryea's victories in the Cosmopolitan Race (New York) and in England; Haynes and Olds; Alexander Winton. Henry Ford's visit to New York: encouragement by Thomas A. Edison. Sale of the quadricycle and beginning of work on new car.

IX. *TIME OF EXPERIMENT* 169

Ford's plans for the future: belief in light car: encouragement and aid from William C. Maybury, mayor of Detroit; other prospective backers. The new

car; Ford's demonstration for William H. Murphy; formation of the Detroit Automobile Company. Ford leaves post of chief engineer for Edison company to become superintendent of his automotive firm. Plans for its growth, demonstration for local post office, a reporter's description of a ride. Difficulties of Detroit Automobile Company; its failure late in 1900. Further automotive developments in the United States; influence of the bicycle on structure and manufacturing processes of gasoline automobile. Some American cars superior to Ford's; his decision, supported by William H. Murphy, to build a racer.

X. *RACING: A PRELUDE* 192

Ford's situation early in 1901: resides with his father and sister as economy measure. The automotive industry at this time; New England its center. Races abroad and at home; pre-eminence of Winton on American tracks; society's adoption of the automobile. Ford's racer: Oliver Barthel assists with design. The Ford family life: Edsel, Clara's character. Detroit's automobile race; Winton and Ford the contestants; Ford's popular victory. Formation of the Henry Ford Company: Ford's position and share in stock. His obsession with racing; Murphy's disapproval; Henry M. Leland as adviser; Ford's withdrawal and association with Tom Cooper. The new and improved racer: Barney Oldfield as driver victorious over Winton; Ford's increasing reputation and plans for a third company.

XI. *THE FORD MOTOR COMPANY* 220

Status of the automobile in America: shift of plants to Detroit; types of promising cars. Ford's association with Malcomson: their plans and progress of the work; Harold Wills in shop and James Couzens in office. Progress with the new car; attempts to sell stock in projected company. Contract with the Dodge Brothers and assistance of John S. Gray; other investors. Formation of the Ford Motor Company with Malcomson and Ford controlling stock; $28,000 cash paid in. Manufacture of first cars and race against bankruptcy; Model A a success. Respective work-areas of Couzens and Ford; Couzens' career and character. Demand for cars; Model A defects remedied; first Ford dealers established. Early success of company; first dividends.

XII. *A BATTLE FOR THE CHEAP CAR* 252

The automotive industry in 1904: position of Detroit with Cadillac, Olds, Packard, Ford and other companies; the automobile in demand The good roads movement: Colonel Albert A. Pope and General Roy Stone; growth of roadage under state aid. The Ford models, A and B; Ford makes mile record on Lake St. Clair ice near Detroit to advertise the expensive Model B. Continuing success of the company; its generous dividends and plans for the new Piquette Avenue plant. Increase of Ford dealers; the new plant and new workers: Galamb, Sorensen, Seeman, Emde. Ford's personality and activity; the Ford and Couzens families. Conflict in the company between Ford, the Dodges, and Couzens, favoring a light car, and Malcomson, advocating the more expensive Model K. Formation of Ford Manufacturing Company as a device to defeat Malcomson. His attitude; investment in Aerocar; stockholders support the Ford-Dodge-Couzens faction.

XIII. *THE SHADOW OF MONOPOLY* 284

Suit of the Electric Vehicle Company against Ford Motor Company for infringement of Selden patent, October, 1903: its importance for the automotive industry. Character of the patent, issued in 1895; Selden's arrangement with [illegible] Vehicle Company and its suits against the Winton and other firms. [illegible] Manufacturers and set- [illegible] rd's inquiries about a license and his rebuff; R. A. [illegible] patent; Ford Motor Company's provocative advertising. Five suits eventually brought, including two against Panhard & Levassor and the Neubauers as importers. Development of legal battle: character of evidence; Selden and Parker; Dugald Clerk; the Selden buggy and the Ford-Lenoir car. Propaganda war parallels legal one; Ford and Couzens help organize an independent automotive association.

XIV. *FORERUNNER: MODEL N* 323

Automotive trends in 1906: the new Ford Model N: its low price and sturdy character. Ford in the factory; success of Model N. Malcomson's surrender: sale of stock to Ford; Couzens acquires stock of other retiring stockholders. Plans for production of a single chassis; Walter Flanders as manager; continuing success of Model N and merger of the Ford Manufacturing and Ford Motor Companies. Norval Hawkins as sales manager relieves Couzens of mounting work; Hawkins' ability and accomplishments. Ford's new racing activities; his interest in vanadium steel and arrangements for its production in the United States; plans for a new and cheaper car.

XV. *NEW GROWTH, NEW PROBLEMS* 354

Effects of panic of 1907: failure of weak firms and concentration of manufacturing activity among fewer companies. Plans for Highland Park plant and for expansion abroad. Ford Motor Company of Canada (Gordon McGregor) and Percival Perry in England. Perry's visit to the United States in 1907 and the establishment of a British branch. H. B White's activities in France and elsewhere in Europe. Changes in the Ford factory: P. E. Martin in charge, assisted by Charles Sorensen; improvements in manufacturing processes. Ford family life: the Edison Avenue house; Edsel's interest in the company; an experiment in aviation. Labor conditions in Detroit: the Employers' Association and the decline of unionism; I. W. W. activities. Working conditions at the Ford plant: reports by a secret operative. New rise in automobile sales; the West an improving market; public interest in a cheap car.

XVI. *THE ADVENT OF MODEL T* 387

Advance publicity on Model T: its characteristics and favorable reception; men associated with its development: Ford, Galamb, Wills. Ford's experimental room; his methods of work. Improvements incorporated in Model T: [illegible] use of vanadium steel, new transmission, a magneto and new car- [illegible] of the new model [illegible] Expansion of the [illegible] tures. Ford cars in the New York-Seattle transcontinental [illegible] mbly plants in the

United States; Perry's success in England. Attempt of W. C. Durant to form the International Motors Company, merging Buick, Olds, Ford, and Maxwell-Briscoe. Durant and General Motors; an offer to buy the Ford Motor Company.

XVII. *NO MONOPOLY* 415

Selden patent case before Judge Charles M. Hough: oral arguments and briefs; Hough's opinion supports the patent. Jubilation of Selden group; Ford's determination to appeal; defections among the independents. The A. L. A. M.'s publicity campaign and Ford's counter-attacks; new suits for infringement started by the Selden group. Oral arguments on appeal; Walter C. Noyes the outstanding judge; his closely reasoned decision favorable to Ford. Results: payment of license fees stopped; Ford and Couzens banquet with the enemy; industry freed for larger activity; patent procedures improved. Effect on Ford Motor Company: purchase of Keim plant at Buffalo. The Fords abroad: business and pleasure in England and France; the Ford and Couzens families and their adjustment to increasing wealth.

XVIII. *A LEVER TO MOVE THE WORLD* 447

America leading the world in automotive production: its large, self-sufficient plants; the moderate-priced car in the ascendant, with a cheap, mass-produced car as next objective. Existing factories paving the way for further progress. To meet Ford's dream of a universal low-priced car, his company must show accomplishments beyond those of other factories. The move to the new Highland Park plant in January, 1910: character of buildings and machinery: a promise of increased efficiency. A visit to the plant: its facilities, arrangement, equipment (new machine tools). Importance of the acquisition of the Keim Mills: its product (pressed steel parts) and personnel: Knudsen, Smith, Lee. Sequential production at Highland Park planned from start. Origins of moving assembly idea; introduction of moving conveyor belt; magneto, engine, and chassis assemblies; final synchronization of entire manufacturing process. Contribution of Clarence Avery. Effect in increased production, 1912–1917. Severance of contractual relationship with Dodges. Expansion and adaptation of facilities to effect full mass production.

XIX. *THE ANATOMY OF SUCCESS* 481

The automobile becoming modernized: the self-starter, electric floodlights, left-hand drive. New roads for the new car: progress under state and federal aid. Revenues from car licenses and gasoline growing; the Lincoln Highway. Lowering prices of Model T: the Ford Motor Company supreme in low-priced field, with almost half the automotive product of the nation. Moderate and high-priced cars: trend toward a few dominant models pronounced. Factors in Ford success: the simple, standardized, low-priced model; good service for parts; economies of large-scale manufacture; youth and ability of Ford executives. Ford's characteristics; purchase of land near Dearborn; friendship with John Burroughs. Further Ford expansion: branch assembly plants. Effects of mass production techniques on output: continuous improvement of processes. Extension of Ford sales organization. Reduction, July, 1914, of the Ford car to a basic price of $440.

XX. *THE FIVE-DOLLAR DAY* 512

Labor conditions throughout the nation: unions on the decline. Employers' Association of Detroit and its growing control; active role of automobile companies in the organization after 1910. The labor supply now mostly foreign-born; the E. A. D.'s work and chief aims. As the largest employer of labor in the automobile field the Ford Motor Company facing a problem. John R. Lee's systemization of workers and wage rates. The company's experiments with profit-sharing, 1905–1913; the challenge of increasing profits. A higher wage as a solution: accounts of its inception; the $5-day announced in January, 1914. Public response: initial praise, later charges of selfish motivation. Causes for the move: desire for steady labor and fear of radicalism not basic; desire to give worker a just share and improve his condition the chief motivation. Dispute between partisans of Ford and Couzens as to credit for measure; possible influence of Clara Ford and Percival Perry in England.

XXI. *THE COMPANY AND THE WORKER* 542

Immediate effect of $5-day announcement: the Ford plant stormed by applicants for work. Character of the new wage: residence and employment qualifications. Clerical workers and women later made eligible. Results of wage in terms of labor costs. Morale of workers: free beneficial services to employees. Assessment of total effects made difficult by European war and rise in living costs. The Sociological Department and its role in qualifying workers for the $5 wage: its investigators and their standards; their activities criticized as invasion of privacy. Standards undoubtedly reasonable and prescribed for workers' good. Every effort made to help workers qualify. Liberal Ford policies as to employment of handicapped and ex-criminals. Provision for adjustment and advancement of employees. Total labor policy notably in advance of current practice.

XXII. *RISING DANGERS* 568

Increasing Ford production, 1915–1916, with enlargements of plant. Ford's proposal to reduce car prices to a basic $345 and attract more buyers. Ford at fifty-three: his philosophy of dynamism. His relationship to Ford Motor Company, 1906–1915: an autocracy modified by able advisers (Couzens, John Dodge, and later Edsel Ford). Dodge Brothers terminate their contract. The executive and operating committees, 1916–1918. Ford moving toward absolute power. His character: small interest in books or conversation, but an original and active mind. His brilliance in matters mechanical: testimony of his associates. Weaknesses of his thinking: intuitional, sometimes uninformed and arbitrary, and often fitful and inconsistent. Soundness of his judgments in fields he knew and their unsoundness in unfamiliar fields. Tendency, with increasing wealth and power, toward aloofness. Dangers from less responsible advisers and from limitations of his own character.

ILLUSTRATIONS

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All photographs except those listed below are reproduced through the courtesy of the Ford Motor Company.

Album of American History, Volume II, copyright, 1945, Charles Scribner's Sons: the *Clermont*—1807; the Erie Canal, 1830–31; inn on the National Turnpike (1827) near Baltimore; arrival of covered wagon caravan at Santa Fe; and the first passenger train in Michigan.

Public Roads Administration: dirt road repaired with pine poles, and a plank road—1846.

Technisches Museum für Industrie und Gewerbe, Vienna: Siegfried Marcus's second motor carriage.

ILLUSTRATIONS

I

THE ROAD: THE WHEEL

On the straight white parkway the careering automobiles reach speeds of sixty, seventy, or perhaps seventy-five miles an hour. Across prairie or plain the streamlined express, the Zephyr, the Super-Chief, the Western Star, rumbles at ninety miles, throwing the state lines behind it. Overhead the mail plane maintains a steady three-hundred-mile pace from coast to coast; or, for shorter distances, a military jet whizzes by at six or seven hundred miles an hour. Distance? It is nothing; it is vanquished. Puck, who boasted of the girdle he would put round the earth, finds men snatching his magic.

In our ever-swifter era we forget how recently men sweated, struggled, and crawled to win a few miles. A battle with distance: how great a part of American history is summed up in that phrase! To plant on three million square miles of wilderness a well-knit nation, to make pathways by water and land which would let Maine and Texas, Minnesota and California quickly exchange products, people, and ideas, to fuse not merely the states but the countless local communities by efficient means of transport—these were ends toward which men struggled, using invention after invention, until they achieved victory. Each step toward success was a step in the defeat of distance and time. Modern America was built on these accomplishments and is bound together by them today. Before we begin one of the most striking chapters in the history of transportation, we must illumine its values by a glance at the meaning of distance in the earlier days of the American republic.

* * *

It is the month of May, 1808, on the Ohio River just below the little town of Louisville. A cultivated young Englishman, Fortescue Cum-

a day across plain and desert until the low adobe houses of Santa Fé break into sight, and crews prepare to barter cloth, knives, guns, and kitchenware for silver Spanish dollars. Like the newer, longer Oregon Trail, this route to the southwest hews out a primitive but important track across a wide span of the continent.[2]

We move the clock forward a few years more. James Freeman Clarke, in his own words "very green and raw," is travelling from Boston to Kentucky to take a Unitarian pastorate. He must cover the whole distance by steamboat or stage-coach. For the coach, five miles an hour is average speed in the East, three miles in the West. Clarke's equipage fords rivers, its wheels sliding off stones or sinking into unsuspected holes. He traverses swampy stretches of corduroy roads; and as their logs rock, break, sink out of sight or rise in air, these sections give the passenger more exercise than pleasure. Repeatedly his coach is overturned; sometimes in pitch darkness the horses wander from the road into the forest. But finally the traveller reaches the great National Pike, then built as far west as Columbus, Ohio.

"At last," mutters Clarke to himself, "I shall make good time." This proves to be not altogether true. The Democrats had opposed internal improvements, and while they could not prevent the building of Henry Clay's road, they could hamper its repair. To cover one twelve-mile stretch takes the stage four hours. Happily, most of the macadamized road is not like this span—is in fact excellent. Before he knows it, Clarke is at Columbus.[3]

The National Pike when Clarke traversed it was the greatest wagon road the world had seen. A few years after his journey it reached Indianapolis and eventually Vandalia, Illinois. Eighty feet wide; a thirty- or forty-foot track in the center macadamized with ten inches of packed stone; carried across small streams by well-built bridges; admirably drained—this straight artery was for years busy day and night. At the height of its fame it was used by ten or twelve through stage lines. Carrying Washington mails in thirty hours to Wheeling, in forty-five hours to Columbus, and in sixty hours to Indianapolis, it brought East and West three days closer to each other. Much of it survives today in Route 40.

Once more we turn our clock forward—this time by forty-five years.

An invalid Scot is journeying from New York to San Francisco by emigrant train. He finds the cars anything but comfortable. Westward from Omaha hard wooden benches serve for seats; toilets are made with tin basins on the platform; at night straw pallets are laid down for beds. No food is available but the milk, eggs, and cakes that can be hurriedly bought at way stations. The trainmen are brusquely unhelpful. As the locomotive toils over the infinite sagebrush plains like a snail, the stench of the unwashed passengers in the hot, unventilated cars becomes intolerable. But the new transcontinental railroad really does subdue distance. It is after all only a few days before the cars are rolling down from the Sierras to the citied hills of San Francisco Bay. And the whole road, spanning the wide republic, seems a marvel to Robert Louis Stevenson:

> When I think how the railroad has been pushed through this unwatered wilderness and haunt of savage tribes, and now will bear an emigrant for some twelve pounds from the Atlantic to the Golden Gates; how at each stage of the construction, roaring, impromptu cities, full of gold and lust and death, sprang up and then died away again, and are now but wayside stations in the desert; how in these uncouth places pig-tailed Chinese pirates worked side by side with border ruffians and broken men from Europe, talking together in a mixed dialect, mostly oaths, gambling, drinking, quarrelling, and murdering like wolves . . .; when I go on to remember that all this epical turmoil was conducted by gentlemen in frock coats, and with a view to nothing more extraordinary than fortune and a subsequent visit to Paris, it seems to me, I own, that this railway were the one typical achievement of the age in which we live. . . . If it be romance, if it be contrast, if it be heroism that we require, what was Troy town to this? [4]

River, canal, trail, macadam pike, railroad: these were five main stages in the subjugation of American distances, with further stages still to come in the automobile parkway and the airplane route. Looking back over our history, we can summon up a series of changing scenes each with a chapter of history behind it. Listen!—the plash of Captain John Smith's pirogue on the James; the slow, steady tramp of the sixty colonists who with Thomas Hooker in 1635 trudge by Indian trail the hundred miles from Cambridge to Hartford on the Connecticut, driving their cattle at a mile an hour; the shouts of Braddock's thirty sailors as they haul the king's wagons by block and tackle up and down the steep Allegheny ravines, building a road still used; the helmsman's

recurrent cry to lounging passengers on the Erie canal-boat, "Low bridge!"; the squeaky fiddle of the lone horseman on the Natchez Trace; the frantic bellowings of the emigrants' oxen crossing the alkali desert beyond Fort Hall; the dull resonant roar of the *Robert E. Lee's* whistle as she heads upstream to Vicksburg; the sound of the hammer driving home the final golden spike that completes the first transcontinental railroad at Promontory Point, Utah. Each stage lifts the imagination with its own color and drama, and in retrospect all fuse into a fundamental theme of American development: the conquest of time and space and the creation of a united land.

2.

The first North American roads were trails: mere footwide paths traced initially by wild beasts (the deer and the buffalo, for example, were admirable engineers) and trodden smoother by generations of moccasined feet. To the Indian equipment for travel, the European at once made two revolutionary additions: the horse (or some hooved substitute) and the wheel. From the day when Cortez took sixteen steeds on his march to Mexico City, the range of travel was theoretically increased far beyond the limits known by the savages. But the forest and other natural impediments made even single-file use of the horse slow and troublesome. When Daniel Boone blazed the line of the future Wilderness Road into Kentucky, a member of his party graphically chronicled their difficulties.

"Come to a turable mountain," he wrote, "that tired us all almost to death to git over. . . . We lodge this night under a granite mountain and Roast a fine fat turkey for our suppers and Eat it without aney Bread. . . . Travel this day along a verey bad hilley way cross one creek whear the horses almost got mired some fell in. . . . We cross Cumberland River and travel down it about 10 miles through some turabel cain-brakes . . . came to a verey ugly Creek with steep banks and have to cross it several times . . . we are obliged to toat our packs over loral [Laurel] river and swim our horses."[5]

Boone and his companions represented one of the five types of pioneers distinguished by Frederick J. Turner in his essay on the frontier[6] as requiring five different modes of transport, each of which successively ushered in a new era.

First appeared the restless fur-traders, moving far and fast beyond

civilization, who sought out the best Indian paths, the least obstructed streams, and the easiest mountain passes; they made little mark upon the wilderness, but amassed a lore valuable to later arrivals. On their heels came cattlemen, the second type, driving herds into the Piedmont, across the Appalachians to the pastures of Ohio and Alabama, and finally out on the trans-Mississippi plains. They, too, needed only a pathway passable to the unburdened animal. The miners of lead, iron, and copper, like the lumbermen launching their rafts, of course required a waterway. The primitive farmers, the fourth type, however, began to lay out packhorse trails and then semi-roads, adequate for animals carrying their small surpluses of cheese, herbs, syrup, whisky, and potash to market, and fetching back "store goods." When disturbed by thickening population, the log-cabin pioneers sold their acres to the "equipped farmers," the fifth and last frontier group. These husbandmen, with bulky crops to transport to the rising towns, made a hasty improvement of roads one of their first tasks. As frame houses went up, as fields were fenced, and as creeks were bridged, the brawny settlers opened roads capable of bearing sledges in winter and heavy carts in summer.

Along the eastern seaboard primitive thoroughfares made such progress that by 1700 hardy colonists were taking continuous horseback journeys from Boston to Philadelphia. By 1732 two "stage waggons" were running across New Jersey, and by 1771 the first stage coach, the "Flying Machine," enabled fair-weather travellers to pass from New York to Philadelphia in a day and a half. Before the Revolution, in fact, wheeled vehicles were driven (with peril and hardship, to be sure) from northern Portsmouth to southern Annapolis. Though it took Washington twelve days to get from Philadelphia to his command before Boston, these crude highways did much to make independence possible. And the first communications opened to far-flung outposts of English settlement in the West served as important a purpose. The Wautauga Road (so-called) was built from the Shenandoah Valley to an island of East Tennessee settlement in 1773, and the Wilderness Road into Kentucky in 1775. Like the Forbes Trail across Pennsylvania, they were mere elementary pathways for pioneer settlers. But however rough and poor these early arteries, they became highways of empire. One historian of Boone's Wilderness Road sums up its varied accomplishments before 1800:

> It established the power of the white man in the Western country. It pierced and broke the center of the barriers which had barred the West against occupation. It divided the Indians in the North from those in the South. It operated as a flank movement upon the powerful tribes which occupied the choicest parts of New York and Pennsylvania, and caused them to give way before the advance of civilization. It made the vast territory of the Northwest, then including Ohio, Indiana, and Illinois, vulnerable to settlement. It opened the way to Tennessee and Alabama, and so crowded the Cherokee Indians in the mountain fastnesses of Northern Georgia that they eventually accepted removal beyond the Mississippi. . . . The direct benefit of the movement which marked out the wilderness trace and trod it into a road did not stop at Boonesboro or the Falls of the Ohio. It extended northward, southward, and westward. It sent its reflex influence back to the seacoast States, and led them all forward to possess the great empire of the West.[7]

The period 1750–1800 was the great era of pack-horse transportation along the rude roads and forest trails. From the Penobscot to the Savannah, a huge business was built up by hundreds of agents using many thousands of mules and horses. Philadelphia was its principal center, and Pennsylvania bridle-paths linking the Atlantic with the Ohio Valley were busy spring and fall with belled animals carrying peltry, ginseng, and other Western products east, and Eastern tools, salt, iron, and cloth westward. Then as boundaries widened and traffic increased, something better than the packhorse was needed on land, as something more efficient than the ark (a combination of "log cabin, fort, floating barnyard, and country grocery") was required on the rivers. Wheeled vehicles demanded thoroughfares on a general scale, and as the eighteenth century closed, the age of the turnpike was born. Since the states could not or would not tax their people heavily enough to build good roads, private enterprise stepped in with highways on which tolls paid for construction and maintenance.

The grant of a charter to the Philadelphia and Lancaster Turnpike Company in 1792 proved an epochal event. Only two years were needed to construct the sixty-two mile highway, admirably surveyed over hill and dale, thirty-seven feet wide, stone paved and gravel covered; and at once it was crowded with handsome private chaises, sturdy stage coaches, emigrant wagons, squat farm carts, and smartly trotting horsemen. As it began paying generous dividends, enterprising men quickly chartered an extension which carried the hard, smooth road

to the Susquehanna. Other groups fell into line. In New York, the Catskill Turnpike, a busy avenue for Yankees intent on Western settlement, came into existence before 1804, when President Dwight of Yale praised its solid qualities. The Mohawk and Hudson Turnpike, running from Albany westward, was invaluable to Mohawk Valley farmers, and a great boon to the nation when in 1812 war materials had to be moved quickly and in quantity. New England caught the turnpike fever. It spread everywhere between 1800 and 1830 except in parts of the deep South; for there the planters took their cotton to market in the fall at such a leisurely pace that they did not care greatly whether they had good roads or bad.[6]

By 1821 New York had 4000 miles of turnpike roads; Pennsylvania had chartered 146 turnpike concerns; Massachusetts boasted an equal number. Baltimore, the nation's third largest city, attributed her commercial eminence in part to her seven trunk-line turnpikes. In Virginia the famous Shenandoah Valley turnpike, ninety-two miles long, carried a heavy traffic. It was so well built that when in the Civil War Stonewall Jackson, seizing five good Baltimore & Ohio locomotives, trundled them down the pike from Winchester to a Confederate railway line at Strasburg, the iron tires hardly dented the macadam paving. Even in South Carolina a pike ran between Charleston and Columbia. It was at the apogee of the turnpike era that the National Road, destined to unwind its 700-mile ribbon of paving from Maryland to Illinois, was born. Traffic started rolling along this great artery on an August day in 1817. Everywhere that the pikes ran, travellers gained a new idea of the importance of time, and shippers were taught a lesson in the feasibility of economy. In the final phase of the era a plank-road movement, first fully launched in the 1840's by a number of wooden highways in central New York, seized the country. Wisconsin formed plank toll-road companies by the score; so did other states. As the planks quickly decayed, however, many concerns abandoned their highways rather than keep them in repair.

Throughout the nineteenth century the carriage maker and wagon builder had driven a thriving trade and constantly improved his art. Good roads or bad roads, vehicles were a necessity. The United States developed its own special types: the buckboard, the spring-wagon, the universally popular buggy, the "surrey with the fringe on top," the peculiar Middle Western work wagon adjustable to grain-tight box or

hay-rack. For heavier passenger and freight hauls men devised respectively the Concord coach and the Conestoga wagon. They had also adapted models used in the Old World: the landau from Germany; the barouche, omnibus, and char-a-banc from France; the victoria, phaeton, dog-cart (first used to carry sportsmen, dogs, and guns to shooting), the Norfolk cart, the tally-ho, the brougham (Lord Brougham's original is in the Kensington Museum) from England; the gig, curricle, drag, brake, pony-cart, and most of the rest. Only a few vehicles, such as the Irish jaunting-car and Joseph Hansom's two-wheeled cab, failed to find an American adaptation or imitation.

The Concord coach and the Conestoga were the proud Titans of American horse-drawn transportation. The Concords, turned out in large numbers by their New Hampshire maker after 1825 and imitated by other manufacturers, soon superseded all rivals for long-distance passenger travel. Their well-balanced bodies were hung above the axles on heavy leather thoroughbraces; their wheels were as tough as they were heavy; their finely-turned panels were gaily decorated; their interiors were lined with silk plush. These Concords were still rolling across the Western plains and mountains in the 1880's.

The Conestogas were the freight-cars of the era. They multiplied in number until it was estimated that on the Philadelphia-Pittsburgh road alone three thousand could be seen at a time. In sheer bulk they were imposing. The high-sided wagon bed, sixteen feet long, was built with a middle dip to give the cargo more room and prevent shifting; the rear wheels stood five to six feet high; the white canvas cover, stretched over hoops that rose eleven feet above the ground, was often twenty-four feet long; and the whole was sturdily framed to brave rocks, ruts, and stumps, and to defy corduroy road or rocky hillside. With six horses pulling it (or mules or oxen), wagon and team stretched out sixty feet. The Conestoga waggoner when not walking drove from a "lazy seat" on the left side, and legend has it that it was he who initiated, or at any rate confirmed, the American custom of keeping to the right. And the driver's long thin cigar, sold at four for a cent, drew its name "stogie" from his wagon.[9]

Not many people today realize how complex, exacting, and fruitful of unfolding inventions was the art of the carriage maker. By the mid-nineteenth century it compared with its forerunner of the sixteenth as the modern science of mathematics does with an abacus. From the

day in 1769 when the Society of Arts in London awarded a sixty guinea prize to J. Hunt for the first shrunk-on tire, soon universally adopted, the carriage maker nobly applied to his trade the growing knowledge of metals and mechanical methods. To develop springs at once strong and resilient, oil-lubricated axles sturdy and smooth-running, and forgings true, durable, and handsome, required prolonged study and experiment. To make a concealed door-hinge that would stand years of use was no easy task. The design of any vehicle was all-important: taking account of seating accommodation, roads, horses, and the due combination of springs, axles, and under-carriage, the designer must aim at ease, harmony, and power. He had to begin with full-sized drawings which united imagination and science; his drafting room was the precursor of those in the automotive industry. The great makers of the Continent, of Britain (who gave the colonies their early tradition), and of America were both artisans and artists. What stateliness went into George Washington's coach—what originality into the phaeton, so light, so graceful, so well adapted to city street or country lane—what strength into the thoroughly buttressed yet not over-heavy prairie schooner!

The tradition of painstaking labor with every vehicle part, destined to come near perfection in automobile factories, was established by the carriage-maker. He had to choose his wood with care from dry, seasoned timbers: ash for the main structure, mahogany for the panels, pine for the roof, birch for the footboards, oak for the spokes—some of the specifications are in Holmes's "The Deacon's One-Hoss Shay." The steel for the springs had to be specially tempered and hardened. Only the best enamelled leather, and the soundest horsehair cushions covered with silk or linen, would do. Many parts had to be ordered (as the automobile maker did later) from special firms: axles, hinges, locks, door-handles, folding steps, lamps, and beadings. Wheels also came from a specialist, who knew just how to cut the mortises in the stock, to fit the tenons accurately, to bore the holes in an exact radial line from the navel, to make sure that the spokes were properly speeched into the hub. The blacksmith work on bolts, sockets, joints, and clevises had to be the best of its kind—when the Studebakers commenced manufacturing they advertised themselves as "wagonmakers and blacksmiths." The painting and varnishing, done from early days

with copal imported from India and South America, had to be smoother and more durable than any other kind of painting.

3.

Before the turnpike waned and while the canal-building era, lent impetus by the success of DeWitt Clinton's Big Ditch, was still booming, the railroad burst upon the young nation; and it quickly became the fundamental roadway of the growing republic. Born in England of the needs of the industrial revolution, it was admirably suited to promote the growth of America in the agricultural age. "Don't pour money into canals," warned hard-headed Moncure Robinson, quitting at nineteen his work with the Virginia Department of Public Works, "the railroads are coming." That was in 1821, when even English railways were primitive. Seven years later, after study abroad, Robinson was making surveys of possible railroad and canal routes for the commonwealth of Pennsylvania. "Should it be really practicable to cross the great Allegheny by a valuable railroad," he wrote one snowy day from a little mountain inn, "an immediate impulse would be given to a species of improvement which is, I am well convinced, to be coextensive with our country." In that year 1828 Joseph Jefferson made a hit in Baltimore with a song in an operetta called "The Steam Coach":

> And we've no longer to gee up and gee ho
> But fiz, fiz off we go
> Nine miles to the hour, with thirty horse power,
> By daytime and nighttime, arrive at the right time,
> Without rumble or jumble, or chance of a tumble,
> As in chaise, gig, or whiskey, when horses are frisky.
> Oh! The Merry Rail Road for me! [10]

Born with a medley of gauges, from the two-foot tramway to the six-foot line which the Erie maintained until 1878; with a variety of rails, from strips of iron on timber to the T-rail which Robert L. Stevens designed in 1830; and with a diversity of roadbeds, from blocks of stone to longitudinal wooden sleepers, the railroad quickly gained maturity, and leaped across valley and plain. Far cheaper to build than canals, it could cross almost any terrain. By 1860, when it was only thirty years old in America, it had woven a web of nearly 31,000 miles over the country; even Illinois, then far to the west, had 2800 miles.

It caught the imagination of the people. Symbolically, the opening of the Erie Railroad in 1851, then the longest railroad in the world save for the Moscow-St. Petersburg line, was celebrated by an excursion in which President Fillmore, half his Cabinet, William L. Marcy, Hamilton Fish, and many Senators and Representatives participated—Daniel Webster sitting in an easy chair fastened to a flat car that he might enjoy the scenery. The excitement which Americans felt in a long train journey was expressed by Ralph Waldo Emerson, as on a lecture tour he saw the engineer goading his boiler with pine-knots:

> The traveller looked out of the car window; the fences passed languidly by; he could scan curiously every post. But very soon the jerk of every pulse of the engine was felt; the whistle of the engineer moaned short moans, as it swept across any highway. He gazed out over the fields; the fences were tormented; every rail and rider writhed and twisted past the window; the snowbanks swam past like fishes; and the speed seemed to increase every moment. The near trees and bushes wove themselves into coloured ribbons. The rocks, walls, the fields themselves streaming like a millrace. The train tore on with jumps and jerks that tested the strength of oak and iron. The passengers seemed to suffer their speed. Meantime the wind cried like a child, complained like a sawmill, whistled like a fife, mowed like an idiot, roared like the sea, and yelled like a demon.[11]

Within sixty years of the time when, in 1829, the first locomotive was placed on the Carbondale-Honesdale line, railroad construction in the United States had exceeded that of all western Europe. But in America the iron and steel highway had certain characteristics unknown to the Old World.

England and the Continent had possessed abundant population, wealth, and commerce, requiring a well-developed body of roads and canals, before the first railways appeared. By 1823, for example, 1500 stage coaches were running daily out of London, most of them over smooth macadamized or telfordized roads; while Britain had a strong system of canals, open the year round. These transportation lines continued to compete with railroads. In the United States, however, and especially west of the Alleghenies, railroads largely preceded the appearance of any considerable population, wealth, or trade. They created these entities. To Europeans, building a railway through unsettled country would have seemed insane. To Americans it was the characteristic practice, for railroads settled the country. As American

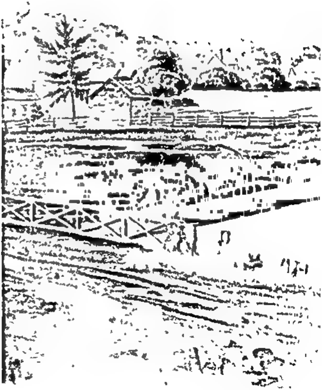
locked, cooperation became the rule, and standard rates were fixed and observed. When the industrial revolution grew in the United States, rails, which had promoted manufacturing, were essential to its efficient life. Every factory was attached to an unbilical line or spur. An elaborate labyrinthine web, brought into harmony by train dispatching systems, precise car accounting, time zones, block signals, and other arrangements, gave the business community almost complete unity. Countless mechanical devices, of which George Westinghouse's pneumatic brake was only the most striking, made possible the change from a freight train of twenty-five cars weighing 1100 tons and running thirty miles an hour to freight trains of 150 cars weighing 12,000 tons and running sixty-five miles an hour.

4.

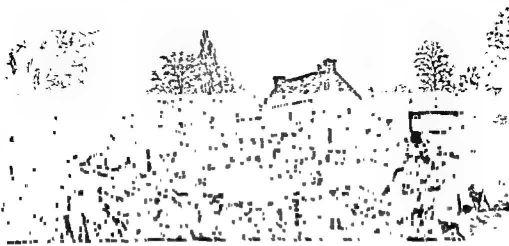
The railroads served cities, towns, and in part the countryside magnificently. But in the long period while they were being built and improved, 1830 to 1890, they almost paralyzed work on the wagon and carriage roads. For one reason, they absorbed the land grants, loans, and cash subsidies which the nation, the states, and the counties might otherwise have devoted to highways. For another, they floated bonds and stock-issues which consumed the capital of investors. And for a third, their competition forced most turnpikes and canals into bankruptcy or merely intermittent activity. They were natural agencies of urbanization in the older parts of the country as they were agencies of colonization in the new; they drew the energy, ambition, and wealth of the land into railroad centers as a magnet would draw iron filings, leaving untouched provincial areas weak and poor.

A railroad town in the Middle West or South was awakened to its daily spasms of vitality by the train whistle much as Mark Twain's Hannibal had been galvanized into life by the steamboat's whistle. Near the station stood a grain elevator, managed by an "elevator man" often controlled by the railway; muddy stockpens, whence hogs and cattle were loaded into stock-cars; a livery stable, with some battered surreys and buggies to rent; and a gaunt hotel or two. The passenger train brought the mail-sacks, the drummers, the visitors from neighboring districts, the youths returning from school, and a few businessmen, giving the station platform a few minutes of bustling activity. The freight trains hastily picked up the cars laden with wheat, baled hay,

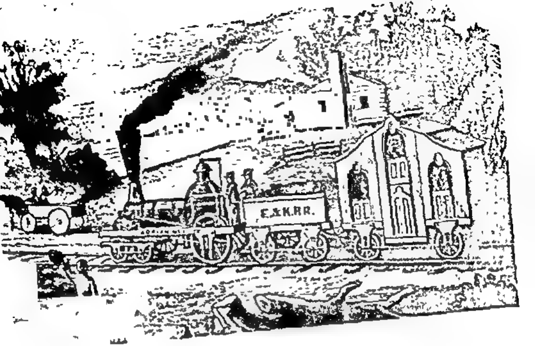
The *Clermont*—1807



The Erie Canal, 1830–31

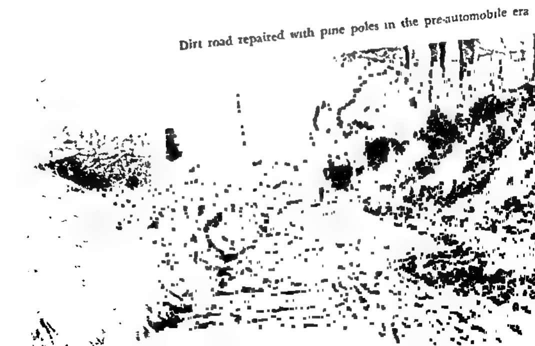


Inn on the National Turnpike (1827) near Baltimore



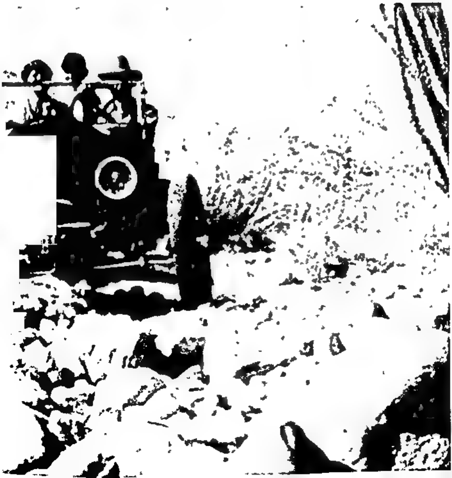
The first passenger train in Michigan

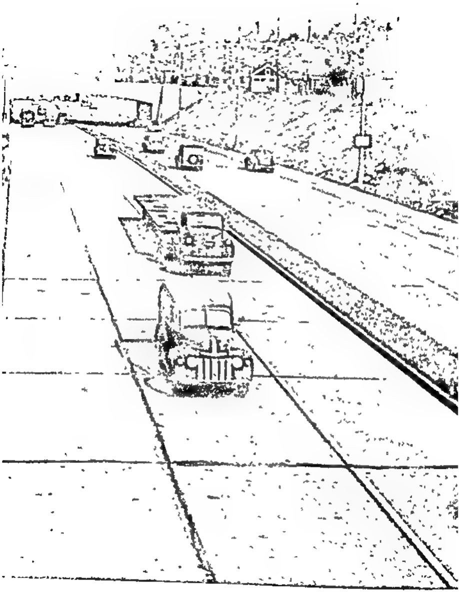
Dirt road repaired with pine poles in the pre-automobile era



An early Ford car, a mountain road, and three Americans who would soon demand better highways

A plank road—1846





Modern six-lane highway, with overpass

or steers, and it hastily dropped a car or two with farm implements, merchandise for the dry goods and grocery stores, and a few packages from the mail-order houses. The station master, who in smaller towns was also the telegraph operator, was a leading man of the community; wages of the section crew did much to regulate the pay of unskilled labor all about.

But the visitor who hired a buckboard and drove out along a country road soon found himself in a different world; a world where ten miles was a great distance, where for long seasons every family was practically farm-bound, and where social isolation wrapped men and women in cobwebs.[14] If the weather was wet the buckboard lurched over ruts, hummocks, and mudholes, careening as one wheel tilted up on a grassy bank while another dropped into a slough, or coming almost to a stop in thick mire. Napoleon had said of Poland that "God, out of water, air, earth, and fire, has created a fifth element, mud"—*la boue;* but Poland never saw mud worse than the red clay of Virginia or the viscid gumbo of Illinois. Culverts with the approaches washed away would threaten to smash a wheel; deep gullies at the roadside would offer constant risk of an overturn. At a township line the traveller might find the road either much better or much worse, and at a county boundary it might disappear altogether; for roadbuilding was entirely a matter for local authorities, who often ignored each other. In winter, barns all along the road would be stuffed with crops awaiting a firm surface. The wayfarer, gazing at them, realized that when dry weather came, all the farmers would fetch their crops to market at once. Prices would sag; a famine of freight cars would ensue; much of the product would be wasted. Everybody knew, too, that when roads were in good shape, it often cost the Western farmer as much to take his grain ten miles to railroad as to ship it thence all the way to New York.[15]

Thus the very force that had led in the expansion of settlement and in the growth of American industry at central points was exerting a deterrent and even a destructive influence on large regions of the country which its tracks did not reach. The railroad ministered well only to such population as was established within a dozen miles of its stations. Thus it ran narrow lanes of effective service across the land, but the myriad communities beyond these lanes lacked service. And, although this fact was not clearly recognized in 1840 or even in 1880, the railroad *could never provide transportation for those outer regions.* That

is, it could not help them get their products to its lines, any more than steamboats or canal barges could assist the farmer distant from their points of call. Yet until some unit of transportation could do for the remote producer what the railroad and steamship did for those close to the towns they touched, America could never be effectively developed economically or socially.

The problem became acute. Millions of individuals felt the penalty of remoteness. Good free land by 1890 was nearly all gone; population was thickening in the older regions; the railway system was practically completed and could furnish no more help. The economic and social losses suffered by the millions who had to dwell beyond the sound of a train-whistle began to seem intolerable. Something had to be done to bring good highways and efficient vehicles to their doors.

But the farming population was never financially able to pave its own roads. Local supervisors were too little trained and too ill-supported even to drain highways efficiently, while the common system of working out the road tax by a stated amount of day labor promoted only the poorest type of work. State aid was as yet unknown, and the federal interest in roads had withered as rail facilities had grown. E. L. Godkin could declare in the *Nation* as late as the 1890's that country roads were no better kept than they had been in John Smith's Virginia, while Nathaniel S. Shaler calculated that in the West the expense of hauling grain was such that to grow wheat more than twenty miles from the railroad was unprofitable, and that the cultivation of bulkier crops like corn and oats would not pay at a distance of more than ten miles.

To some extent the growth of cities promised a partial answer to the problem. As they became more crowded they surrounded themselves with suburban belts which found rapid all-year road travel indispensable. City and suburban engineers knew and to some extent applied the epochal principles of Telford and McAdam, and road supervisers near them observed and profited. Moreover, various new materials were being used in the towns for surfacing. Asphalt, utilized in the France of Louis Napoleon, had been employed in the United States after the Civil War, the natural pitch beds of Trinidad furnishing a source for material. Brick was extensively employed, especially in the Middle West. Wood blocks, cobblestones, gravel, and granite blocks joined with telfordizing and macadamizing to make better city streets. The use of crude oil, sand, and clay presently helped to improve urban

thoroughfares and much-used rural roads. But while some good roads pushed out from the towns, they were usually few and short, while even within the cities themselves the surfacing of streets was neglected. In Washington a third of them in 1890 were unsurfaced dirt, in Pittsburgh about two-fifths, in New Orleans and Kansas City more than four-fifths. Even Manhattan depended upon many dirt roadways, and as we shall see later, the streets of Detroit were notoriously poor.

What was more, the surfaced road did not provide a real remedy so long as it remained merely a road for horse-drawn traffic. It would still leave the remoter areas without transportation comparable with that enjoyed by communities near the railroads. Socially and economically, the isolation of the greater part of the rural population had a profound significance, and gradually men recognized the urgent need for a new type of vehicle on a new and far more comprehensive system of roads. With time and struggle, a group of pioneers would furnish an answer to the problem.

When it came, it would do for all parts of the land what the railroad and steamship had done for a considerable part. It would do more: it would alter the city and the life of its inhabitants almost as much as it would transform the work and life of the country. The railroad and steamship were after all limited units, severely bound to their rails, their river channels, and their harbors. Automobile traffic would be wholly free-moving. Completing and vastly improving the wretched roads of the land, giving the rural village and the remote farmer a mobility that put him on almost equal terms with the inhabitants of the terminal cities, quickening the processes of these communities, providing power machinery for agricultural and other work as well as for transportation, it would usher in one of the greatest of the world's mechanical revolutions.

To trace the part played in this revolution by one company, a few leaders, and their evergrowing body of associates, is the task of this book. We must begin before the beginning, in one of the rural areas of America, troubled by those needs and hungers which produced the extraordinary changes to be narrated.

II

THE PIONEERS

HAD any man predicted in 1895 that within twenty years American industry would be more completely remade than in the whole previous century, most people would have asked in amazement: "What, after Stephenson, Whitney, Morse, Bessemer, McCormick, Edison?"

Yet the prophecy would have been true. During those twenty years the development of automatic machine tools, already astonishing, would continue with miraculous results. Factory procedure would be revolutionized by mass-production techniques—a combination of precision, continuity, speed, and standardization that opened new horizons in production. Industrial administration would be transformed by the rise of efficiency engineering ("Taylorism") and the emergence of a class of professional managers. Engineering would be sea-changed by a division into much more specialized and expert branches. Invention would continue its breakneck pace, with spectacular achievements in transportation—the automobile and the airplane. As a result, in 1915 unskilled labor would be able to produce fifty times the quantity of many products that skilled labor had turned out twenty years earlier, and immensely improve the quality of what was made.

The story of this new industrial revolution is largely the story of the men who made it. Our general concern in following the growth of modern transportation must therefore be with these pioneers; our special concern with the most widely known of the group, Henry Ford.

The whittling farm-boy is one of the commonest figures in the history of American technology; the intent lad in jeans watching the blacksmith mend a mower, fascinated by the gears of a water-mill, or exploring the mysteries of a clock. Up to a certain point, the farm and the machine are allies in nourishing an eager inventive talent; beyond that point they are enemies. Take for example three lads who grew

up early in the nation's history on Worcester County farms in Massachusetts. Tom Blanchard at thirteen invents an apple-parer, useful on a farm; at eighteen he works in a tack factory, and is soon inventing first a tack-counting and then a tack-making machine. Before long he is one of the masters of the Springfield Arsenal. Elias Howe likes to tinker with the grist-mill on his father's homestead, an occupation which fits rural life. Then at sixteen he is an apprentice in a Lowell factory for making textile machinery—his sewing machine lying just ahead. Eli Whitney combines farm chores and forge work; restlessly ambitious, he saves money to go to Yale—with what result everybody knows. The farm is a sound teacher of ingenuity and of elementary mechanical skills. Before long, however, its lessons are ended, and the youth whose imagination is fired by railroads, steamboats, cotton mills, machine shops, and gun factories looks to a larger sphere.

Nearly all the chief founders of the American automotive industry came from rural environments, and not unnaturally a considerable group of them were born about the same time. Elwood Haynes first saw the light in 1857 in a small Indiana community. Charles Edgar Duryea came to farmer parents in 1861 near Canton, Illinois. Ransom E. Olds was born in 1864 as the son of a village mechanic at Geneva in northern Ohio. Overseas, Alexander Winton began his life in a rural area of Scotland in 1860.

These men were younger than Edison, Westinghouse, and Alexander Graham Bell, just as the industry they founded was younger than the electric light, the airbrake and the telephone; they were older than the Wright brothers, just as their handiwork was older than the airplane. In some respects their careers ran closely parallel, and in others were singularly divergent. We shall find their paths crossing at times, and again veering wide apart.

2.

In the early morning of July 30, 1863, the house of William Ford rose whitely from its flat Michigan setting, a simple two-story clapboarded structure flanked on the west by a clump of small fruit trees, and on the east by several farm buildings. The land immediately about had been cleared and tilled, but patches of timber still studded the ninety-acre farm, while to the south a heavy line of forest reminded old residents that this district near Dearborn had not long since been

a dense wilderness. Even yet the houses were relatively rude in appearance, and the road running past the Ford home was narrow and heavily rutted.[1]

Inside the house was an air of excitement, for Mary Litogot Ford, William's young wife, was about to give birth to her second child. Her foster parents, Margaret and Patrick O'Hern, were with her; while her husband had gone to fetch Mrs. Holmes, a midwife who lived several miles to the northeast.[2] Mary Ford's first child had not lived;[3] her husband, an alert, wiry man of medium height, blue-eyed and bearded,[4] hoped for better fortune with this one. Dawn was just breaking as he brought Mrs. Holmes. A little later, at seven o'clock, the child who would be named Henry Ford arrived, well-formed and healthy. The midwife had earned the five dollars William paid her—a generous fee when men worked for a dollar to a dollar and a half a day, when beefsteak cost six cents a pound in Detroit, and an eight-room house could be rented for $9 a month.[5]

These were stirring times in which to be born. Not a month earlier, at Gettysburg, many boys from Dearborn, Springwells, Redford, and other townships of Wayne County had fought well, some of them perishing; the First, Fifth, Seventh, Sixteenth, and Twenty-fourth Michigan Infantry, the Fifth Cavalry, and Battery I had taken part in the three-day struggle.[6] At Dearbornville arsenal new recruits were drilling that very morning.[7] Mary Ford had lost her brother John in the war.* If the household contained any newspapers, they would have carried echoes of the draft riots just quelled in New York. William Ford, however, had not volunteered for service; he was sticking close to the arduous task of wresting a living from the half-tamed land here, not far from the growing town of Detroit and the junction of Lakes Huron and Erie.

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* Two of her brothers enlisted—John and Barney Litogot They are shown together in one of a number of pictures Henry Ford later acquired from his mother's relatives—young men in [illegible]

General *for the State of Michigan for the year 1862*, 227, and same for 1865–66, 591. Meager notes on Barney's wife and children appear in the Litogot Albums noted above.

William was an Irish immigrant, although by ancestry partly and perhaps wholly of English Protestant stock. He had left County Cork for the United States sixteen years earlier. Not much is known about the family in Ireland. According to records presented by Dr. Charles A. Webster, an Anglican clergyman and scholar of some prominence in the Cork area, William's father John had been a tenant on a farm included in an estate called Madame,[8] lying chiefly in the parish of Kilmalooda, near the village of Ballenascarthy. The town of Clonakilty, on the coast southwest of the city of Cork, was only about three miles from the farm. Part of this extended into the neighboring parish of Kilmagross, and John's house lay half in one parish, half in the other.[9]

What was the origin of the Fords at Madame? When Henry Ford became wealthy and widely known, he instituted an inquiry into this question, which various associates—E. G. Liebold, Frank Campsall, and Raymond H. Laird in Detroit and Dearborn, and Edward Grace of the Ford plant in Cork—helped to prosecute.[10] A number of false leads were followed and rejected. Finally Dr. Webster, who had a large library on Irish estates and families, was retained to make researches. In a typed memorandum of twenty-one pages entitled "Notes, Topographical, Historical, and Genealogical, on the Ford Family" he submitted careful findings which Laird, Campsall, and others accepted.[11] His conclusion, supported by meagre evidence, was that the Fords had once been farmers, some freeholders, some tenants, in Somerset and Devon, England. When in 1585 Queen Elizabeth had granted about 600,000 acres of confiscated lands in Munster to various English gentlemen, among them Sir Walter Raleigh and the poet Edmund Spenser, to be settled by English farmers and artisans, the Fords had crossed to Ireland. Webster found that Sir John Starvell, one of the recipients of Elizabeth's grants, had brought over a number of English colonists about 1601, and that some Fords, previously his tenants, were among them. The Fords of Clonakilty thus may have come in a direct line from the colonizing yeomen of Shakespeare's day. Like other English migrants to this part of County Cork, they were a militant type of Protestant. A couplet is said to have appeared on the gate of the town of Bandon in this era announcing that

A Turk, a Jew, or an Atheist,
May live in this town, but no Papist,

and an audacious Catholic was supposed to have scribbled beneath it the apt rejoinder:

> He that wrote these lines did write them well,
> As the same is written on the gates of Hell.*

Dr. Webster's genealogical report was challenged by a theory of a more recent English origin proposed by Lord Percival Perry, long the able head of the Ford enterprises in Great Britain. He had assisted in the effort to trace the line of descent, and had interviewed several residents of Cork who declared that they knew the family history well. "He'd not a spot of Irish blood in him," Perry said of Henry Ford in 1952. "The only Irish thing about Mr. Henry Ford was that his grandfather was a farmer in Essex. He was doing rather badly there and went over to Clonakilty and rented a farm." A Cork inn-keeper and others said that they knew this English migrant, and Lord Perry believed that he had actually found the Essex farm which the man had left. So far as certifiable evidence is concerned, this more recent move might have been possible, though it would probably have been Henry Ford's great-grandfather, born in 1775, who made it. John, who died in Dearborn in 1864, was believed by his family to have been born in Ireland.[12]

The weight of evidence, however, reenforced by family tradition, lies with Dr. Webster's conclusions. It need scarcely be said that Ford, as a common English name, is frequently met in all parts of the British Isles, in the United States, in the Dominions, and indeed throughout the world. One notable family in Ireland, from which Dr. Webster himself claimed descent, was the Fords of Meath, who had left Lancashire in the seventeenth century.[13] After Henry Ford became famous, his mail was filled with letters from Fords in many states, in Australia, Canada, and other lands, inquiring about a possible relationship; as much as the Smiths, Robinsons, and Joneses, the Fords were ubiquitous. Henry Ford's staff had to deny that he was related to inmates of state hospitals, to New England farmers, and to John T. Ford, the theatrical manager of Edwin Booth's day. The industrialist may have been pleased to learn from an Iowa professor that a seventeenth century Henry Ford of Upparts in Sussex had been described by William Cam-

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* [illegible] popular doggerel.

den in his *Britannica* as "an ingenious mechanical gentleman, who raised the Thames water into the highest streets of the city [London] 93 feet high in eight pipes, and built the great water engine near Somerset House."[14] The *Dictionary of National Biography* lists twenty-three Fords of some distinction, and the *Dictionary of American Biography* nine.

3.

Let us turn back to the particular group of Fords who reached America in the 1830's and '40's, and made their homes in pioneer Michigan. The first to come to the New World were three brothers, Samuel, Henry, and George, sons of William Ford, leaseholder of Madame, brothers of John Ford and thus grand-uncles of Henry Ford the industrialist.[15] They arrived at Dearborn in 1832. Doubtless they were attracted by the considerations which prompted many English, Scottish, and Irish families to migrate during the first half of the nineteenth century: cheap land, the opportunities of a growing country, and a more liberal government and society than they had known. Clyde Ford, one of Samuel's descendants, in a twentieth century memoir about the family and early Dearborn, states that the brothers turned to the United States "with the desire and determination to establish homes in which the fullest sense of freedom and independence could be had to the utmost."[16] Though somewhat rhetorical, this assertion has the ring of a deeply-felt emotion carried down the generations by family tradition.

Fifteen years after the advance guard of Fords in 1832, came John Ford, grandfather of the industrialist, and his son William, with whom we have begun our narrative.[17]

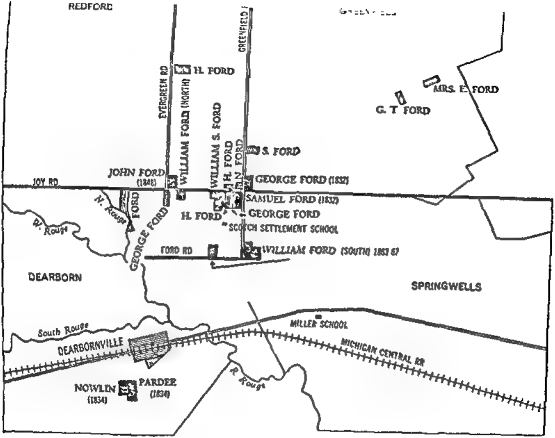
The first three Fords, according to the memoir just noted, went westward from New York or Philadelphia by land, and "one brother, Henry, who was left at a house along the trail in Pennsylvania to be taken care of for sickness . . . was never heard of by the family again." The approximate date when the two survivors arrived at Detroit and soon afterward at Dearborn is fixed by the records of the former General Land Office in the National Archives at Washington. These show that on May 23, 1832, Samuel Ford purchased 80 acres of land in the extreme northeastern corner of Dearborn township, and that on October 1, 1832, George Ford purchased 40 acres in the extreme south-

western corner of Greenfield, adding another 40 to this the following year. Each paid $100 all told, and their holdings touched each other at the township boundaries. In 1832 George found a wife in Alice Good of Detroit.[18]

Michigan at that time was frontier territory, not to become a state for five years. Most Americans thought of it as wilderness, associated with the fur trade for which early Detroit was a French, then a British, and finally an American post; with the conspiracy of Pontiac; with the shameful capture of General William Hull early in the War of 1812; and with the defeat of the British and Tecumseh in October, 1813. As a region hospitable to settlement, it had emerged only in the eighteen twenties. The first lake steamer, *Walk-on-the-Water*, had appeared in 1818, providing precarious transportation from Buffalo to Detroit. Then the opening of the Erie Canal in 1825 and the building of the Detroit-Chicago road during the following years offered better routes to and across Michigan and invited settlers to pour in; the 9000 inhabitants of 1820 became 31,639 ten years later, with Detroit claiming almost 5000 of the total. But in 1832 the massive wildness of Michigan had scarcely been broached. It was still a region of few roads or good trails, of dense forests, wolves, bears, and Indians.

We have no record of the hardships, fears, and achievements of George and Samuel Ford, but we do possess the history of an American family of similar experiences in Michigan. In 1832 a farmer named John Nowlin in Putnam County, New York, felt the ambition to seek a new and better life, and his story has been told by a son, then a boy of eleven.[19] The elder Nowlin had worked hard and made small headway on his stony acres. He declared bitterly one day "that it was impossible for a poor man to get along and support his family; that he could never get any land for his children there, and he would sell what he had and go to a better country where land was cheap."

He fixed his eyes upon Michigan. His wife, who the doctor feared was consumptive, was aghast; the four children shared her feeling. However, Nowlin was adamant. The farm was sold, he rented a place, shopped for an outfit in New York City, and the following spring went to "view" Michigan. He bought eighty acres of land near Dearbornville, about six miles southwest of where the Fords had settled, then returned, and after visiting relatives during the winter, set out in the spring of 1834 for Detroit. The Nowlins reached Buffalo by way of



Map showing various Ford farms and the Nowlin farm. Chief original Ford farms in black with dates of acquisition, also lands of William, son of John (William South). Other farms, shaded, are those shown in 1876 Atlas. The names of roads are those of today.

the Erie Canal, and there boarded a lake steamer, as Samuel and George Ford doubtless had done two years earlier.

In Detroit, still almost as much a French as an American town, the Nowlins were somewhat reassured by the signs of civilization which they encountered, and the air of hustling growth. The day after their arrival Nowlin took his son out to the Dearborn area to see the farm he had bought. The two went west along the new Chicago Road, as the Ford men must have done two years earlier. After a few miles of straggling settlement it was walled on either side by high, dark forests. Ten miles out the Nowlins came to Dearbornville, on the River Rouge, where an Army arsenal was being constructed by Lieutenant Joshua Howard. A brickyard near by operated by Titus Dort, an early settler, supplied material for the cluster of buildings which were already rising. To the east of the arsenal was a tavern kept by a Mr. Thompson, while the older Ten Eyck hostelry fronted the road a little closer to Detriot. Already a few private dwellings marked the beginning of the village. The Chicago Road ran to the south of the Army grounds, which occupied a slight elevation with loamy, well-drained soil.[20]

Southward from Dearbornville a wide lane penetrated the forest, the timber having been cut for a mile preparatory to opening a road. From the end of this track Nowlin and his son plunged into the woods, following an Indian trail for two miles to reach their land, although on an air line the distance was not a mile. Adjoining their holding to the west was the property of a settler named Pardee, who had already cleared a small opening among the trees and erected a dwelling. The remainder of both "farms" was primeval forest.

The eager boy, digging in the earth, found it "black and rich, and sure enough no stones." Pardee heartily invited his new neighbors to share his rude house while they built their own, and Nowlin arranged with the tavern-keeper Thompson for the use of a team and wagon. He then sent his son back to Detroit to tell Mrs. Nowlin that next day he would bring the family and their possessions to their own land.

It was late afternoon, and as the youngster hurried back along the Chicago Road the sun was nearing the tops of the trees. Soon twilight came. "I could just see a streak ahead four or five miles, with trees standing thick and dark on either side. If ever a boy put in good time I did then." It was dark when he reached town, having travelled twenty-six miles going and coming. His mother was pleased and doubt-

less relieved to see him. "I told her I was glad we came, how nice the land was, what a fine country it would be in a few years, and . . . said, if we lived, I would take her back in a few years, to visit her old home."

Nowlin brought his goods and family to their land. Swinging a seven-pound axe he had purchased in New York, he cleared a building site and felled trees to provide timbers for the house. When he had the logs ready, men came from Dearbornville to help him raise the frame. The cabin had a fireplace and a stick-and-clay chimney, a door, and at least two windows. For the roof Nowlin cut black ash trees, peeled the bark, and laid it in strips as rough shingles, battening them down with small stringers of timber. In two weeks "we moved into a house of our own, had a farm of our own, and owed no one."

In this account we can follow the essential activities of the Fords just after their arrival two years earlier. Their sense of the wildness of the place would have been sharper, considering the trim Irish farms they had known. On the other hand, their delight in the possibilities of the land would have been greater. Good farmers, they would have noted the black soil, and the unlimited supply of splendid timber—oak, hickory, ash, maple. Clyde Ford says of their first days: "The sense of freedom, the feeling of independence, the opportunity to meet the necessities with all their natural resourcefulness, caused the trails of the forest to become visions of highways, the favorable locations at crossroads, river and stream, places where great cities would arise containing all the things which they wished succeeding generations to enjoy."[21]

For the Nowlins, clearing the site of a cabin and erecting it marked only the beginning of the struggle to create a farm. When after weeks of back-breaking ax work, and weeks more of piling logs with a newly-purchased team of oxen and burning logs and brush, they at length had a few acres studded with stumps; when with more labor they had hacked out a road of sorts to the north of their line; when they had filled in swampy areas and fought mosquitoes by day and night—then they were still far from having made their land productive.

The first year the cleared area was so small that it received the sun only from about ten in the morning until between one and two in the afternoon. The corn they planted grew desperately toward the light, was all stalk and leaf, and bore only a few stunted ears. The follow-

ing year the slow process of clearing continued. With the end of the third season about sixty acres, most of it still filled with stumps, were in use, and a cow provided the family with milk. An early writer has described the results of such heavy work. "Amid the clearings of the forest, the log-hut of the pioneer curled its smoke to the heavens from the banks of lakes and streams; and amid the stumps and felled trunks of trees, little patches of wheat glowed in the sun like green islands amid the vast and magnificent ocean of wilderness."[22] The picture is poetic; it does not indicate the sweat, the heartbreaks, and the dragging time required to produce these oases of cultivation. Had game not been plentiful the family, waiting for delayed harvests, would have lacked sufficient food.

The Fords carved out their own islands of wheat, pasture, and truck garden. They were hardy settlers, and tradition reports that mechanical aptitude was a family trait. Samuel and George were skilled woodcutters. "The swing of an ax driving the properly ground edge into the heart of the sturdy giants of the forest could compare favorably with the finest golf stroke of a champion." The cutting "would be done with all the smoothest possible strokes, every one counting, and when finally the cut was made it would be as if it had been planed with a plane."[23]

The women did their share. Using punkwood from soft maples, a flint, and a jackknife, they would light their fires,[24] cook on the rude hearths, make candles, spin wool, weave cloth, help draw maple sap and boil it for syrup, tend their chickens, milk their cows, and "take their baskets of butter and eggs or maple sugar on their arms and set out on foot to the central part of Detroit to a store which stood on the corner of what is now Fort and Underwood Avenue . . . a distance of about ten miles over the trail which followed a small creek . . . to a point south where the trail took off on higher ground to the city of Detroit." George's wife Alice was once frightened off the trail by an animal, probably a bear, and was lost in the woods all night. Finally an ox-cart was procured for trips to town. It was driven by Samuel's son Henry, then about ten, because the older men could not be spared for such light activity.[25]

It was a rugged, driving life, enlivened only by attendance at church (at first held in homes or in a newly-erected schoolhouse), a few parties where there was dancing, the pioneer "bees" at which various labors

were performed in a social setting, and, for the men, the hunting of deer, turkeys, and bear; with seasonal fishing. "The days and nights spent fishing in the River Rouge," runs one account, "will always remain a part of the history of the community. The fishing was done by dip nets as they were called, and seines, which were large bag nets held by two men who would wade into the water and hold the mouth of the net open by means of a stake on each side. While two men in a flat boat would approach the net with two more standing in front of the boat slapping the water with long poles, driving the fish, which were mostly mullet, into the net."[26]

Wolves were hunted, too. Sometimes they measured six feet "from nose to tail point,"[27] and brought a bounty. Deerskin, bearskin, and wolf furs were used for leggings, shirts, rugs, and robes, saving work with the spindle and the loom. The wolves were now more the stuff of decoration for frontier talk than dangers or nuisances. Conrad Ten Eyck in his tavern on the Chicago Road used to call out loudly when guests arrived, "Sally, put some more wolf-steak on!" Once he is reported to have assured a naïve young woman that she had actually eaten this rugged dish, and drew the calm reply: "Then I suppose I must be a wolverine." Sally Ten Eyck Tompkins later denied any practical basis for her father's talk. "No, I do not think we ever cooked wolf meat. Father was very fond of a joke."[28]

4.

The toil and excitements of Dearborn were the talk at the Ford supper table in Kilmalooda. During the 1830's letters borne back to Ireland by infrequent sailing ships must have come to Madame, to be read and discussed with wonder. Out of their pages rose the image of America, gigantic, savage, yet aglow with promise. But it was personalized in these communications. John Ford, his wife Thomasina, his mother, and the children Rebecca and William, could see the new country as a setting for the farms of Sam and Nancy, George and Alice. As the years passed Jane and Henry, born in 1829 and 1830 respectively, Mary (1832), and the newcomers Nancy (1834) and Samuel (1837) became interested listeners.[29] When the 1840's began, William was in his 'teens, and could join responsibly in talk about a possible migration to America.

By 1846 two factors made this topic highly important. The potato

blight had come to Ireland, devastating the entire land. A population of more than 8,000,000 people who, if politically and economically dissatisfied, had been relatively prosperous, now suddenly ceased to be self-supporting. More than a million were to die from the effects of want, and millions more were to emigrate. Again, the Fords in America, having improved their land, must now have been sending reports of their achievements and hopes which held out an enticing alternative to the cruel life in Ireland. Why endure poverty and anxiety when a richer land offered prosperity along with the fullest social and political freedom?

Such a question might well have precipitated a decision by the group in Ireland to follow the first adventuring Fords. But a new disaster may have put additional pressure upon them. According to a letter written by Charles Bateman of Ballinghassig, County Cork, in 1924, John Ford and his family were evicted from their farm at the very height of the famine. Bateman was related to the Fords, and was telling a story passed down through the family for many years. Its evidential value is probably small, particularly as Bateman is mistaken in some other statements he makes, including the name of the farm and of one of the Ford family. However, difficulty about the lease may be regarded as a possible factor in the action which the family now took.[30]

They sailed for America in 1847. The group comprised Rebecca Jennings Ford, now seventy-one; John Ford, his wife Thomasina, and their seven children; John's brother Robert Ford, with his daughter Mary Ann, and probably his wife and three sons.[31] In the letter by Charles Bateman just noted, we find a description of young William Ford, John's son, as he prepared to leave Ireland:

> He was driven in a common cart from his home at Crohane to Bandon station, County Cork, to entrain for Queenstown so as to sail for America, by his young cousin Henry Ford (whose father Sam and your grandmother were brother and sister) who lived at Knockea, in a farm one and one half miles from the old Ford home, Crohane.
>
> William borrowed £2 to help him out to America, from his cousin that drove him to the station. He took saws, hammers and various tools with him.

This one fragment, lending a touch of the personal to the departure, rings true in this respect: in America young William Ford proved to

be skilled with tools. But with this brief legendary glimpse of preparations for the voyage our knowledge of it fades into conjecture.

We are not even sure of the port where the emigrants' ship finally docked. While the Fords in Dearborn later assumed that it was New York,[32] other and better evidence indicates that it was Quebec. One fact is agreed upon: either during the voyage or just after her arrival in America, Thomasina Smith Ford died. Mrs. Margaret Ford Ruddiman, Henry Ford's sister, was told by her father (William) that his mother had died and been buried at sea. However, Mrs. Esther Flaherty MacDonald of Ferndale, Michigan, the daughter of John Ford's daughter Nancy, informed Dr. M. M. Quaife, then collecting material for the Detroit Public Library: "My grandmother became very sick on board and when they got to Quebec, my mother said she died in the quarantine hospital in Quebec." On another occasion Mrs. MacDonald thought that the death occurred at Ottawa.[33] A Canadian archivist, in explaining why evidence upon deaths in Quebec is often missing, gives a touching picture of the conditions the immigrants faced. "During 1847, those Irish immigrants died there at the Quarantine Hospital, and were buried altogether, sometimes as many as eight to ten at the same time. The officiating priest reported in the entries, at the time, that it was impossible for him to inscribe the names and other details concerning the identifications, because sometimes the whole family members had died."[34]

John Ford and his seven sons and daughters, the youngest ten years of age, continued their journey. Assuming that they arrived in Canada, where Robert and his family remained, they could have proceeded up the St. Lawrence, then across Lake Ontario to Buffalo, and thence by lake steamer to Detroit. Clyde Ford says merely that John "located farther west on what is now Bonapart Ave. or the old Redford-Dearborn Townline."[35] (That is, on the present Joy Road between Southfield and Evergreen.) A descendant of one of the families already in the area supplies a little additional information, stating that John Ford and his family arrived about 1848; that they were almost lost, wandering through the clearings from Dearbornville to the Scotch Settlement, trying to find their kinsman, Samuel Ford; and that they finally met a young man of fifteen, working in a field of stumps, who directed them.[36]

They did not find Samuel, for he had died in 1842. But on the farm

he had cleared, and on other acres near by resided his grown sons William and Henry, with two of their grown sisters and five younger children. Both men were married, and William and his wife Ann (Ketchum) had a brood of four. John's youngest brother George, his wife Alice, and their six children were still on the farm, touching Samuel's at the northeast, which George had acquired in 1832.* It cannot be doubted that the newcomers were received jubilantly by these relatives. There would be tears and talk and laughter. Fiddlers would probably be summoned, and the whole Ford clan, reunited after fifteen years, would have feasted and danced. Then the nine immigrants would have been distributed among their kinsfolk until John Ford could find land and build a habitation. What kind of farm could he get? Despite the lapse of time since the first settlement of the early 1830's, almost half the area of Dearborn Township was still primeval forest. If its wildness startled John and his two sturdy sons, its wealth of timber and promise of future harvests could well have unleashed the brightest hopes. At the old Samuel Ford farm and at George's they could gaze with dazzled eyes at the well-tilled fields, barns, houses, fruit trees, sheep, cattle.

John soon found a place. Not far west along Division Road (now Joy) on which William and Henry dwelt lay some land belonging to Henry Maybury or Mayberry. Maybury, who was said to have known the Fords in Ireland and was related to a Maybury who later became mayor of Detroit, had acquired 160 acres in Redford township, locating 120 of these in 1834 and getting his patent from the government for $100. He was willing to part with 80 acres, selling them to John on January 15, 1848, for $350, for $150 of which he took a mortgage (cancelled December 4, 1850). This plot lay not half a mile from the original Samuel Ford farm. Possibly part of it had been improved, but the price suggests that it was mostly woodland.[37] However, three men were available to clear the trees and build a house; they could [illegible] ree miles [illegible] with her [illegible] two, and Mary, fifteen, managing the housekeeping.

Thus John and his children became part of the Michigan frontier.

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* To relate the various Ford families to each other, with their various Williams, Samuels, Henrys, and Georges, the reader should consult the chart which is Appendix I. The accompanying sketch map shows the location of the chief Ford farms of these and later years.

We shall hear little of him; he drops into the immense new land like a pebble into a pool, leaving only a few ripples behind. He and his sons were soon working "in a field of stumps," carving their farm from the forest. "We children," said Margaret Ford Ruddiman, "grew up with those memories of the pioneers in our little settlement as our guide."[23]

III

THE CHILDHOOD OF AN INDUSTRIALIST

EVEN while Michigan was being hacked from the wilderness, some of its leaders felt that they were developing a new type of economic life based upon machinery. "What stupendous consequence does American mechanical philosophy . . . exhibit throughout the country!" exclaimed James Lanman, one of the state's first historians, in 1839. "The railroad, the canal, the steam boat, the thousand modes and powers by which machinery is propelled, how vastly has it augmented the sum of human happiness! What glorious prospects does it open before us! . . . Pouring its millions into the wilderness, it has sent forth, not serfs, but hardy, practical, enterprising men, the founders of empires, who have finished the work of erecting states before the wolf and panther have fled from their dens. Bestriding the lakes and streams which discharge their waters through the Mississippi, it has studded them with nearly seven hundred floating palaces, to conquer winds, waves, and tides."[1]

Thus the spirit of the machine age stirred grandiloquently in Michigan even as its settlers subdued the wilderness by hand! During the next four decades that age itself grew from early promise into a gianthood of iron power, the shadow of which eventually fell on Detroit and Dearborn. Dozens of technological devices and processes developed in that period: the rotary printing press, the turret lathe, the Bessemer process, the vulcanization of rubber, the dynamo, the typewriter, the suspension bridge, the electric light, the screw propeller, the Maxim gun. Old inventions expanded in use; the few railroads of 1840 became a web that enmeshed the continent, steamers multiplied on lakes, rivers, and ocean, telegraph wires reached every city, while

from the Atlantic Coast cables ran out across the ocean floor to relay messages to the seven seas. Detroit as early as 1849 had its iron foundry, its steam sawmills, its busy machine shops. To the south in Wyandotte, the shipping leader Eber B. Ward established a blast furnace and rolling mill in the 1850's, and used the Bessemer converter before the Civil War ended. By 1875 Detroit, with stove works, carriage factories, car works, brass foundries, machine and engine manufactories, varnish plants and breweries, was beginning to be a thriving industrial center.[2]

A farm youth reared on the outskirts of Detroit could not escape the influences of the time and place. As Henry Ford entered childhood just after the Civil War, he could sometimes see on the horizon to the southeast a haze made by the heavy smoke of the freighters constantly passing between Lake Erie on the south and Lakes St. Clair and Huron on the north; he could see to the east the faint but ever-denser smudge of Detroit's numerous small mills, factories, and machine shops. Similarly, Ransom E. Olds, growing into childhood on the outskirts of Cleveland, where he attended public school, was awakened by its strident industries—iron and steel, ship-building, farm implements, oil-refining—to a sense of the new pulses beating in America. The Duryea brothers growing up in their Illinois village were almost suburban to Peoria and Pekin, two manufacturing towns, the former one of the busiest rail centers of the Middle West. Alexander Winton, schooled just below Glasgow in that Clydeside area where the clangor of shipyards never ceased, got his best lessons first in his father's little farm implement shop, then in the yards, and then in the engine-rooms of steamships.[3]

Even little Dearbornville, the Fords' own village, had known in the 1840's a touch of the coming industrial era; a description of it enumerates "a sawmill with double saws, flour mills . . . seven stores, two smitheries, and a foundry for iron, propelled by water power, a physician, and about sixty families."[4] Long before Henry Ford was born the community had lost the wilderness quality it still possessed when his grandfather John and his father William first arrived there. At that time, the farms were clearings in the woodland, and the usual Wayne County road was a "black, sticky" affair, with "slough-holes, dug-ways, and morasses." At first declares one writer, "except the road through the Black Swamp, from Toledo to Lower Sandusky, there were no more fearful and horrid roads to be found than all those leading

out from Detroit in 1833 to 1837."[5] In the 1840's, however, a plank road had been built from Detroit westward, reaching Dearbornville by 1848, and providing the farmers (for a toll charge of twenty cents each way) a fairly good highway into the city. "Internal improvements" was a popular cry when the Fords first reached America. Before the Civil War, three railroad lines had thrust westward from Detroit across southern Michigan, one of them, originally called the Detroit & St. Joseph and later the Michigan Central, running through the township of Dearborn.[6]

2.

The story of Henry Ford's parents, while so interesting that it is worth telling elsewhere at some length,* must here be briefly summarized. William was not alone a farmer; to some slight degree, he made himself part of the developing industrial era in mid-century Michigan, for he had a variety of skills.

Grandfather John Ford (the grandfather, that is, of Henry Ford the industrialist) naturally expected all his sons to contribute to family maintenance from an early age. Burdened with a mortgage of $150, no small sum in those days, and probably with other debts incurred in transporting ten persons from Ireland to America, making his down payment of $200 on the farm, and purchasing live stock and farm equipment, John had to cast about to find ready money at once, and to insure a continuing supply, for his unimproved acres could hardly yield respectable crops in the first two or three years. Fortunately, a ready market existed for cordwood (then burned by the newly-built railroads and by charcoal makers as well as by the rapidly increasing number of Detroit householders), and for timber. John Ford thus obtained some cash return from the trees which he and his sons laboriously cleared from the farm.[7]

William, however, soon found a better way of earning money. The Michigan Central Railroad, already past Dearborn, was extending its tracks farther westward to Lake Michigan; it needed labor; and for several years William gave it much of his time. A good many farm youths accumulated capital in this fashion. One of them, William Nowlin, has left us an exact description of how the tracks were laid

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* See Appendix II.

on hand-hewn timbers, crossed by ties, on which stringers were set. These, topped by strap iron, made the rails.[8]

Though William Ford doubtless worked on this roadbed, he may have been employed more frequently as carpenter on the various buildings—stations, sheds, freight houses, tanks—erected as the line pushed westward for more than two hundred miles. In 1848 the Michigan Central, with an operational force of only 276 men, employed 2500 "in constructing."[9]

At certain periods William could return to his parents and help clear their land, a labor he was always eager to resume. The whole family, bringing a long tradition of farm living from Ireland, were keenly appreciative of the opportunity to acquire and improve the extensive acreage their new country made it possible for them to acquire. "My father," says Margaret Ford Ruddiman, "often recalled the pride which he and his father had for their own lands and their own homes. In later years the great miracle of America still seemed to be to him that here was a place where a man could own the land upon which he lived and with which he worked." She felt that while the potato blight may have been a vital factor in sending the family to America, the opportunity to own land was a "very powerful influence" upon William Ford in particular.[10]

What William did after the Michigan Central reached Lake Michigan in 1849, and its docks there were completed, we do not know. Family tradition declares that he returned to the farm and helped his father place it on a productive basis, doing carpenter work when opportunity offered. In the late 1850's we discover him again, now employed by Patrick O'Hern, who owned a 91-acre farm in the townships of Dearborn and Springwells. Patrick, a native of County Cork, had come to America about 1830. He was reported to have served as a British soldier in Canada, and then to have selected the United States as his permanent place of residence.[11] He had married Margaret Stevens of Detroit on July 15, 1834—she an Episcopalian, he a Catholic; they had acquired land which was assessed by 1850 at $1000, a respectable sum in those days; and they had gained a standing in the community.

In the O'Hern home William Ford found one child, an adopted girl named Mary, only ten years old in 1850. She was the daughter of William Litogot, a carpenter of Wyandotte, who had been killed some-

time in the 1840's; "he fell off a house," said Mrs. Ruddiman.[12] Apparently the mother was then dead, or died soon after the accident. Of the Litogots, who are supposed to have been Dutch or Belgian Flemish by descent, little can be learned. Mary, one of four children, was gladly taken by the O'Herns, who were childless. They gave her the warmest love and devotion, and she returned them a full and happy affection. Soon she was attending the school in the neighboring Scotch Settlement—a community of exceptional cultural and moral standards, established in the 1830's by a large number of families from Scotland, Ulster, and England.[13] Mary seems to have set a high value on the schooling she received, which was doubtless supplemented by the guidance of Margaret Stevens O'Hern. She was reared in the Episcopal faith.

William Ford was a sturdy young man of twenty-six when Mary Litogot O'Hern was twelve. For a number of years, as he helped her foster father with farm work and carpentering, he watched her grow up. Early photographs taken of her show a dark-haired, dark-eyed young woman with a hint of a smile, and an air of earnestness and integrity. "She was small and quick of movement," recalls her daughter Margaret. "She had brown hair and dark eyes, and had a manner and vivacity which were well remembered by all who knew her." It was not unnatural that as she reached young womanhood, William should become attracted to and finally fall in love with her. By 1860 he was able to think of marriage, for he had saved some money, and on September 15, 1858, had bought forty acres of land from his father, paying $600.[14]

On April 25, 1861, William Ford and Mary Litogot were married. A certificate, bearing the day but not the year, survives, written and signed by the officiating clergyman, Edward Dinrocke, of St. Peter's Episcopal Church in Detroit. Giving William's residence as Redford (his father's home), and Mary's as Greenfield, the post office address of the O'Herns, it states that the marriage took place "in the house of Mr. Thos. Mayberry in the city of Detroit."[15] The family record book declares that the two were united "by Bishop McCoskry in the church," and family tradition not only supports this but adds that a wedding supper was served afterwards in one of the roadside inns. However, the certificate seems to be authoritative.[16]

From the beginning a close family relationship existed between the

newly-married couple and the O'Herns. Patrick and William were from the same part of Ireland. Building their lives in a new community, they were naturally drawn to each other. Immediately after the wedding the younger man and his bride moved into the O'Hern home, a rude log structure, while William and Patrick, with the help of neighbors, began to build a new house nearby, half of it in Dearborn and half in Springwells township, which the two families would occupy jointly. It was a two-story structure of seven rooms—a spacious parlor, a good-sized kitchen-living room, and five bedrooms. Later, more rooms were added—a new kitchen, a laundry room, a storage room, and another bedroom; so that the house which Henry Ford knew as a boy had eleven rooms in all. It was possible for the O'Herns, the two Fords, and a growing family of Ford children to dwell in it comfortably.[17]

At the same time, the O'Herns assisted the young couple generously. Patrick and his wife were growing old, they wanted their daughter and her husband to feel secure, and they were glad to drop the hard toil of the farm. In a somewhat complicated series of transactions in 1863–67, the O'Herns sold their ninety-one acres to William Ford, who gave them a life-lease on part of the property. William obtained some of the money needed for these purchases by selling in 1865, for the excellent price of $2500, the forty acres he had obtained from his father. Clearly, the idea was that William would do most of the work on the farm, and ought to have title, subject to his providing a home for the O'Herns and reasonable financial security for them. The O'Herns, naturally, were more prosperous at the time of the marriage than William and his wife; not only had they owned more than twice as much land, but Patrick in 1863 had paid taxes on $133 worth of personal property, William on only $75 worth. Mary would eventually inherit everything the O'Herns had.[18]

From the time of the marriage the two families became one, knit together by a warm and loyal affection. Mary had her parents still, and acquired a husband; the O'Herns acquired a son-in-law and eventually grand-children. William became the owner of a profitable farm, to which he added as opportunity offered. He grew grain and hay, owned horses and sheep, and cut wood for fuel and timber. A small orchard provided apples, peaches, and other fruits for family use; a herd of cows supplied dairy products—butter, milk, and cream—both for the

home and for the market. No doubt he was ready on occasion to use his carpentering tools and skills for anyone who would pay him. The income which he drew from a variety of sources seems to have been more than sufficient.[19]

When the second child and first son, born in 1863, was named Henry, it was doubtless in honor of his father's younger brother, who had gone to California in the gold rush, remained there, and himself become the father of a number of children.

3.

The child Henry Ford toddled about on the Dearborn farm amid pleasant surroundings. The land, though a stiff clay and somewhat hard to work, was fertile. Beyond the yard with its pump, beyond the evergreen shrubs and the orchard, well-cultivated fields were broken by patches of timber. Wild flowers bloomed in the fence corners and on the margins of the woods; butterflies rose from moist patches of the earth, and dragonflies circled marshy pools; on spring mornings the meadowlarks, song sparrows, brown-thrushes, catbirds, bobolinks, and bluejays raised a merry din. Gazing out over the April fields with his grandfather, as he called Patrick, or his father, the boy at times heard the lusty drumming of the partridge, or saw the bird as it whirred into sudden flight. He became familiar with the small wild animals of the region: rabbits, skunks, raccoons, foxes, minks, and muskrats.[20]

"The first thing I remember in my life," he wrote years afterward, "is my father taking my brother and myself to see a bird's nest under a big oak twenty rods east of our home and my birth place. John was *so young that he could not walk. Father carried him. I being two* years older could run along with them. This must have been the year 1866 in June. I remember the nest with four eggs and also the bird and hearing it sing."[21] Later he discovered that it was a song sparrow. His interest in wild life was nourished by other incidents; for example, he remembered his father turning the plow aside to spare a bird's nest.

About a quarter of a mile southwest and south of the house ran Roulo Creek, bordered with willows and alders, which boiled with water during the spring rains, but was a quiet brook the greater part of the year. It emptied into the Rouge River several miles below. Along its banks grew cattails, sweetflags and wildflowers; occasionally wild ducks alighted on it. The Rouge flowed down from the north about

two miles due west of the Ford farm, running through a thickly-wooded region southeast to the Detroit River; the stream at the point nearest the Ford home was from seventy-five to a hundred feet in width. Doubtless little Henry sat with the family under tall trees when they picnicked by the Rouge, alone or with neighbors or relatives. More than forty years later he would build a home there. The men would lounge and talk, discussing President Grant or grumbling about the ill-kept plank road to Detroit, and the low price of farm products. William Ford was well informed. Doubtless he was a subscriber to the *Michigan Farmer* and after its founding in 1871 to the Wayne County *Courier*, and perhaps was already taking a New York paper, as he did later.[22]

The boy never knew either of his real grandfathers, for John Ford died in March, 1864, and was buried in the Ford Cemetery on Division (later Joy) Road. Nor did he know his Uncle Henry, who wrote that spring from Fort Hogum, Idaho Territory, where he had gone to try his luck in a new gold field, leaving his family on the coast. Henry remembered the Michigan winters with a shudder: they "are so Cold back there and long and i like the Climate in California so well on a Count of no Snow in the winter and Pleasant in the Summer." He had apparently heard from William, and was glad "to hear that you and your wife and children were well." (There was of course only one child.) "Thank God for his Mercis to us all."[23]

William and Mary soon had the children that Uncle Henry attributed to them: John, their second, arrived in February, 1865; Margaret was born on August 14, 1867; Jane in 1869, William in 1871, and Robert in 1873.[24]

These were busy years for Henry Ford's mother. As he reached school age she had the care of four children and her heavy household work: cooking (at first in the fireplace), washing, churning, making candles and soap (kerosene lamps were first used by the Fords during or just after the war),[25] knitting, clothes-making, preserving, and caring for chickens and garden. Margaret O'Hern, now past eighty, was an additional burden; she died during the year 1870.

Mary Ford seems to have taught her oldest son to read, for in one of his "diaries" an undated entry runs, "Could read all the first reader before I started school. My mother taught me."[26] Although Henry Ford sentimentalized his early home, and on some mechanical matters

used his imagination pretty freely, this jotting is undoubtedly accurate. We know that Mary Litogot Ford had been an earnest student at school and was a devoted mother. Equally important were the practical lessons the boy learned from the busy farm life about him—for agriculture in those days demanded great resourcefulness and a wide array of skills.[27]

"The settler had to be able to cope with any situation," writes Frank L. Stevenson in "Memories of the Scotch Settlement," "blacksmith, wheelwright, rigger, builder . . . though for the most part, farmer." Among the Ford clan and their neighbors, states Clyde Ford in his reminiscences, a keen rivalry was evinced in the performance of various tasks. "To be the first one in the spring to get the oats sown was an accomplishment in itself and so on right through the whole season. . . . Not only was the much desired thing to get these things done first, but they had to be done right. A crooked furrow behind the plow or a crooked corn row were things that were well on to a disgrace." The Fords were progressive. "My grandfather and his brothers ran what was probably the first threshing machine around this part of the country, a machine driven by the old horse power." Later they substituted improved models "till the last horse-power was a heavy cast iron machine with five sweeps to which could be hitched ten horses."[28]

All the farmers in the Ford and Scotch settlements salted their pork, smoked their ham and bacon, dug pits for preserving fruits and vegetables through the winter, and tapped their own maples for syrup and sugar. "The smoke house," writes Stevenson, "was often a good-sized tree in the woods which, in the course of time, had rotted out inside. Failing as a tree, it was taken down and made into a good smoke house, set on end near the homesites." Every farmer had to make and repair many of his own tools, and to become a practical mechanic, mason, painter, and carpenter. They knew all the arts of trapping, hunting and tanning.

4.

On January 11, 1871, Henry walked one and one-half miles to the Scotch Settlement School house to begin his formal education. He was almost seven and a half years old, but his statement in one of his "diaries" that "No one went to (school) at six years old" was in general true of his community.[29] The schoolhouse, which lay northwest

of his home on what is now Warren Avenue in Dearborn, was of red brick built in 1861.[30] For its day and for a country district it was modern, with glass windows, a stove, plain seats and desks which accommodated two pupils each, a few benches, and a blackboard. The teacher's desk stood at the front, with a long bench immediately before it to which the classes were called for recitations.[31]

Henry Ford's sister Margaret has described the school day as she knew it four years later. "We started school off with a song or a prayer," she said. "There wasn't any set schedule. It depended on the mood of the teacher. . . . There were two classes in spelling, one before noon and one before the close of school. We had reading, writing and arithmetic. Our writing was on old copy books. We had spelldowns and spelling bees. We had to read our lessons over several times to enunciate and learn the pronunciation. They tried to teach moral lessons, too, from the things we read. The McGuffey Readers were our first books. I have a set. They would explain the little stories with the morals in them and the reasons for it."[32]

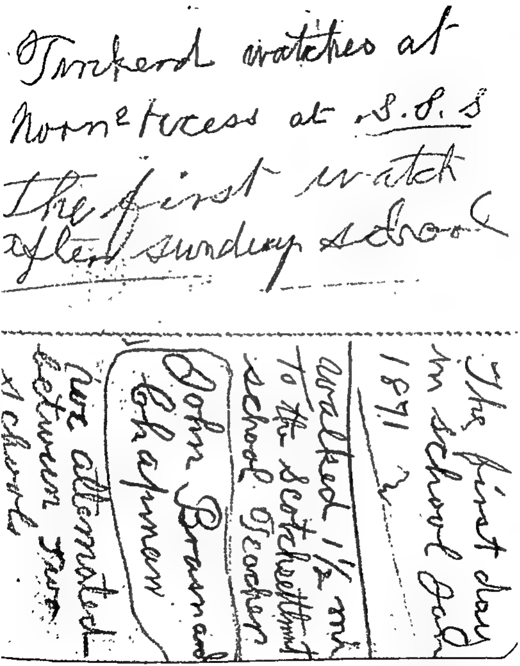
The youngster who arrived that January morning in 1871 was hardly a stranger to the other pupils. The Stevensons, Ruddimans, and Forsytes were neighbors. He may also have known by sight the teacher, seventeen-year-old Emily Nardin, for William Ford was now on the district school board.[33] The new pupil found a companion in Edsel Ruddiman, who lived on Southfield Road three-quarters of a mile from the school. Lively and mischievous, the boys played many pranks on each other and their mates. Once Henry threw a dart at a boy's leg, and got jabbed with a knife in return.[34] Edsel as a young man at college wrote his former chum about their activities. "Do you remember how we used to write notes to each other in school? and the alphabet we devised so that the teacher couldn't read it. That seems a long time ago. I remember distinctly one time Miss Proctor kept us there on the back seat in the corner and gave us a lecture on being better boys. I am afraid she labored in vain to reform two such hard cases as we are."[35] Henry Ford in the years of his fame hunted for a stove like that in the Scotch Settlement School, and was precise in specifying certain features. "When a boy got in trouble he was brought up front and placed on the 'mourners' bench' directly under the teacher's eye," he explained. "You could get a good view of the stove from that location, and I sat there so much of the time that it was indelibly impressed

hooked up to an old coffee mill, with a rake handle as connecting rod, and the boys experimented in grinding clay, potatoes, and some pea-sized gravel which threw off sparks. Unfortunately, they left the dam when they had finished their experiment, and during the night the ditch overflowed, flooding the potato patch of a neighboring farmer. Henry Ford may well have exaggerated the amount of flooding, for he never scrupled to add a touch of the dramatic in recounting his experiences. The story as he finally told it in print pictured the farmer as a furious man who demolished the dam and loudly complained to the teacher, Addison Brush. Mrs. Ruddiman, who was also attending the Miller School, did not remember that the flooding produced any startling protests. "It was just a small dam," she remarked.[43]

Another experiment involved a "steam turbine" which Henry and his companions constructed and set up against the school fence. In one of his diaries Ford noted that the engine ran very fast, at 3000 RPM, but developed little power. Finally the boiler exploded with disastrous effect. "Blew a piece through my lip," Ford recorded in his little notebook, "and a piece hit Robert Blake in the stomach—abdomen, and put him *out*." What was even more unfortunate was that the school fence caught fire and was partially consumed. William Ford repaired it. He did not punish or scold his son, but quietly explained that carelessness in such play could be very dangerous.[44]

Simonds in his *Henry Ford* also tells of a forge which the boys built; and one of Henry's former schoolmates, Marvin Miller, was perhaps thinking of this in 1943 when he said that the steam turbine was made "in a shed at the rear of the school."[45] The boys, says Simonds, also rigged up a blower "motivated by a wheel from a corn sheller," and after melting glass, recast it in various shapes.[46] Ford has an undated entry in a notebook: "Melting brass glass and lead for castings."

As Henry grew older, his father recognized his mechanical ability, and gave him such opportunity to exercise it as the farm afforded. The boy made a device by which the driver of a wagon could open and close the farm gate without leaving his seat. He hammered out hinges at the family forge, reset the handles of tools, and repaired harness and wagons. Always "tinkering," he was curious as to how anything mechanical operated. If new toys came to the Ford home someone was sure to exclaim: "Don't let Henry see them! He'll take them apart!"[47]



Tinkerd watches at
noon recess at S.S.S
The first watch
after sunday school

The first day
in school Jan
1871

walked 1½ mi
to the Scotch settlmnt
school Teacher
John Brown and
Chapman

we alternated
between two
schools

Two pages of one of Henry Ford's diaries, which contain his recollections as to early school days and watch-repairing

Mary Litogot Ford and William Ford, parents of Henry Ford. The picture of William shows him in his later years.

Birthplace of Henry Ford

Clara Bryant Ford

The "Square House," where Henry and Clara Ford resided from early 1889 to September, 1891

With the machine and crafts aspects of farm life the boy was doubtless happy, but these were pitifully limited. He took no pleasure at all in the endless farm drudgery. "My earliest recollection is that, considering the results, there was too much work on the place," he wrote in *My Life and Work*. "Even when very young I suspected that much might be done in a better way. That is what took me to mechanics—although my mother always said that I was a born mechanic. I had a kind of workshop with odds and ends of metal for tools before I had anything else. In those days we did not have the toys of today; what we had were home made. My toys were all tools—they still are!" Again, "From the beginning I could never work up much interest in the labour of farming. I wanted to have something to do with machinery." And still again: "I have followed many a weary mile behind a plow and I know all the drudgery of it. What a waste it is for a human being to spend hours and days behind a slowly moving team of horses when in the same time a tractor could do six times as much work!" Although these are all comments long after the event, they recapture a mood of dissatisfaction which undoubtedly was a real characteristic of the growing boy, and became stronger with the years. His early love for the mechanical was associated with a distaste for farm toils.[48]

Looking back, Henry Ford thought that his mother perceived his bent and was sympathetic with it. His sister Margaret believed that William Ford, too, recognized the boy's talent and was more friendly to it than the son afterwards acknowledged. It was the mother who dominated the home that Henry later recalled with sentimental fondness. "Mother presided over it and ruled it," he told Edgar A. Guest in 1923 in a frank interview. "She made it a good place to be." She was the wise guide, he felt, in checking his boyish follies, and the companion who lent a happy spirit to leisure hours. "Maybe . . . that's what the modern family needs to learn," Ford declared, "the art of being happy with each other. It was Mother's idea. More than once I've heard her say . . . that if we couldn't be happy here in this house [he and Guest were talking in the homestead that he had restored] we'd never be happy anywhere else."[49]

Mary Ford, according to her son, had a deep sense of obligation. "Fun we had and plenty of it, but she was forever reminding us that life cannot be all fun. 'You must earn the right to play,' she used to

say to me. One of her sayings used to be, 'The best fun follows a duty done.'[illegible] Often she read to her children from *Gems of Life,* a collection of inspiring essays and statements by writers and orators of the day. Henry believed that his mother had a quick understanding of her children. "She could read our minds, she knew what we were thinking of and what we were planning to do." She might say to her oldest son on a spring morning: "Henry, you are not to think of going swimming with the other boys after school. It is much too early, and the water is still too cold." Henry and his brother John would be confused at this startling divination of their program.

"We used to carry our lunches to school," he told Guest. "Mother was not a believer in fancy cakes for children. She gave us plain, wholesome food, not so sweet to the taste, but better for the health—good bread and beef sandwiches." But one of the other boys had cake with frosting on it, and Henry coveted this. He negotiated, gave up his beef sandwich, and got the cake. "I thought I was making a good trade." Unfortunately, the rich food upset him and his mother was puzzled, until his younger brother John asked why she didn't give them cake, and was told it was not good for growing boys. "Well, Henry eats it," John remonstrated; "he trades his sandwiches for cake." That was the end of the trafficking in lunches; his mother forbade it, and Henry didn't dare continue. "When Mother made up her mind to anything, she never stopped until she accomplished her purpose."[50]

Mary Ford also gave her son a philosophy concerning work. "My chore was to take care of the horses," he told Guest. "I didn't like that job then and I wouldn't like it now [there seems to have been an instinctive aversion on his part to horses, as if he realized that later he would do much to displace them]. . . . But Mother held me to the job because she knew it was better for me. She taught me that disagreeable jobs call for courage and patience and self-discipline, and she taught me also that 'I don't want to' gets a fellow nowhere. . . . My mother used to say, when I grumbled about it, 'Life will give you many unpleasant tasks to do; your duty will be hard and disagreeable and painful to you at times, but you must do it. You may have pity on others, but you must not pity yourself. Do what you find to do, and what you know you must do, to the best of your ability.' "

Mary Ford never resorted to corporal punishment, but used more efficient penalties. "Shame cuts more deeply than a whip," Ford re-

called. "Once, when I told a lie, Mother made me suffer the experience of a liar. For a day I was treated with contempt and I knew that I had done a despicable thing. There was no smiling at or glossing over my shortcomings. I learned from her that wrong-doing carries its own punishment. There is no escape."

She was also insistent on order and cleanliness, her love for which was transmitted to her son. When visitors to his factories in later years would compliment him on their neatness, he would say, "Well, you know, I get that from my Dutch mother."[51] When as a young man Henry Ford acquired a steam engine for sawing wood, he immediately used a hammer and chisel to remove a walnut jacket around the cylinder in order to expose the brass lining between the jacket and the casting. William Ford was somewhat shocked. "Why did you do that?" he asked his son. Henry replied: "I want to have something that shines."[52]

The influence of Mary Ford on her son, by his own evidence, profoundly affected his whole career and work. "I have tried to live my life as my mother would have wished," he told Edgar Guest. "I believe I have done, as far as I could, just what she hoped for me." The influence of his father was undoubtedly exerted with no less benefit in a stabilizing direction. Henry as boy and youth was highly charged with energy, and increasingly drawn toward things mechanical. His parents guided him to a working adjustment between his environment and his passionate interest in tools and wheels. But the interest could not be denied; as he entered his 'teens it increased, for only a few miles eastward from his father's farm American industry was throbbing and tangible at the docks, shops, and factories of Detroit.

In March, 1876, Mary Litogot Ford was expecting another child, the eighth she had borne. There was no reason to feel apprehensive about the impending event. She seems never to have had unusual difficulty in childbirth, and at thirty-seven she was still a relatively young and healthy woman. Dr. S. P. Duffield was called in. Something went wrong; the child was lost, and twelve days later, on March 29, Mrs. Ford died.[53] The entire family was devastated. Henry was old enough to share his father's feeling with something like an adult's grief; all the younger children were stricken and bewildered. As Henry said years afterward, the house was like a watch without a mainspring.[54] Mary was buried at the Ford Cemetery on Joy Road, where most of

the Fords have been interred, and a simple tombstone erected with the inscription:

> Mary Litticot Ford (wife of William Ford)
> Born 1839
> Died March 29, 1876
> aged 37 years
> Dearest Thou hast left us. It is thy loss
> we deeply mourn. But it is God that hath
> berieved [sic] us. He can all our sorrows
> heal again. In Heaven we hope to greet thee,
> where no farewell tears are shed.[65]

When William Ford, now fifty, carried his wife to the graveyard, undoubtedly he buried with her a rich aspect of the life he had lived. Within a year his youngest son, Robert, died at the age of four. But like his wife, William had a firm sense of duty. He had a family of children to rear, five after the loss of Robert, and bent himself to give them the care they needed. His sister Rebecca Flaherty came for a brief period to manage the household, then left her daughter Jane, a young woman of twenty, to take over that duty.[66] Margaret Ford, then only nine, did what she could and in a few years assumed an increased responsibility. She and Jane worked together pleasantly. "She was like a sister to us, not like a taskmaster." In time Margaret became the sole manager of the household, assisted by her own younger sister Jane. Later she emphasized the normal, busy, cheerful quality of Ford family life, which she felt that her brother tended to romanticize. "It was neither as colorful and romantic as it has been painted—neither was it as full of hardship."

The house at this period was much like the "restored" home which Henry Ford created when he removed the original building to Greenfield Village and supplied it with furnishings as near those he remembered as he could discover. This home of the 1870's, as already pointed out, was considerably larger than that of 1863, and better equipped as to heating, cooking facilities (a range), water (a pump at the sink), and storage and laundry rooms. At some time near the turn of the century the building was moved a short distance to the east to permit Greenfield Road, which had stopped at what is now Ford Road, to reach the Chicago Road to the south, later called Michigan.[67] About this time a large basement was dug for the house, which had

previously had only a small root cellar.[58] The appearance of the place in 1876 is shown accurately in the Atlas for Wayne County of that year. The neat picket fence, the spacious yard, the pump, the barns and sheds, the decorative evergreens, the orchard west of the building, are all clearly represented. This was the home of Henry Ford's boyhood, which he was soon to leave.

IV

YOUTH AND THE MACHINES

In the year of his mother's death three important events impressed themselves deeply upon young Henry Ford. The first and most dramatic happened in July, just before he was thirteen. Driving with his father to Detroit, he encountered a steam engine proceeding along the road under its own power. It was a sight almost as astounding to the boy as if Elijah's chariot of fire had suddenly appeared.

"I remember that engine as though I had seen it only yesterday," he declared forty-seven years later. It was the first road vehicle not drawn by horses that he had ever encountered. As the engine stopped to let the Fords pass, "I was off the wagon and talking to the engineer before my father, who was driving, knew what I was up to." The engine was used for stationary purposes—for threshing or sawing wood—but was able to move from place to place under its own power. "It was simply a portable engine and boiler mounted on wheels with a water tank and coal cart trailing behind." The stationary engines which Henry had previously seen had always been drawn from job to job by horses. "This one had a chain that made a connection between the engine and the rear wheels of the wagon-like frame on which the boiler had been mounted."[1] Once the machine had arrived at a work-site this chain was disconnected, and a long leather belt was put on the drive-wheel to apply the power to threshing or sawing.[2]

The engineer was glad to explain his machine, which was made by Nichols, Shepard & Co. of Battle Creek, Michigan. This one man, standing on a platform behind the boiler, shovelled coal, operated the throttle, and steered; when he wanted to stop he simply shifted the chain pinion. Long afterward, testifying in court, Ford showed that his recollection of the entire mechanism was clear and accurate:

Q. How many turns a minute did these Nichols, Shepard & Co. engines run?

A. I suppose about 200.

Q. Why do you suppose; why don't you remember?

A. Because I never counted them.

Q. Why do you guess 200?

A. Because I asked the man that was running it how fast the engine ran and he told me 200 turns a minute; and I have never forgotten it.

Q. And you remember that ever since you were a boy of twelve?

A. Yes, sir, as distinctly as anything I can remember yesterday.[3]

Later, in one of his diaries, Ford recorded the name of the operator, Fred Reden. "Mr. Reden let me fire and run the engine many times that and the next year. He was a good and kind man." He adds of the experience: "That showed me that I was by instinct an engineer."[4]

Thus the possibility of an engine being used as a self-propelled vehicle was implanted in Henry's mind, to haunt it and fire his imagination for years to come.

2.

It had already haunted the imaginations of many men, flowering into a vision of free locomotion which preceded by many years the first passenger-carrying railroad, and continued even after that event to dangle alluring possibilities of vehicles unfettered by rails.

The power of steam had been recognized by the ancient Greeks. Hero of Alexandria (130 B.C.) described in his *Pneumatica* elementary machines driven by steam which might be called shadowy ancestors of the steam turbine and steam pressure engine. However, the possibilities of steam were never really grasped by the ancients, and did not become a theme of discussion until early modern times, when a reviving interest in science took account of them. Giovanni Battista della Porta in 1601 discussed the uses of steam with some real insight into the problems of a practical engine, and Sir Isaac Newton in 1680 prophesied that steam as a propulsive force would introduce a new and superior means of transportation. He envisaged a steam carriage.[5]

The first practical application of such ideas was made by Thomas Savery in 1698, when he procured a patent on an ingenious engine which raised water by creating a vacuum in a pipe. Better engines by Thomas Newcomen (1705) and others came into widespread use for

limited purposes in England during the first half of the eighteenth century; and then James Watt by his series of epochal inventions 1762–1782 made revolutionary improvements, finally producing a double-acting engine—steam being applied alternatively to the lower and upper ends of the piston—which opened the way for the use of steam power in many operations besides pumping. And Watt, with his partner Matthew Boulton, as everybody knows, first manufactured and sold engines with conspicuous success.

Later, in France, Nicholas Joseph Cugnot, an engineer and artillery officer, devised a three-wheeled vehicle which he proposed to use as a gun tractor. It was "actuated by two single acting brass cylinders, connected by an iron steam pipe with a round boiler of copper containing firepot and chimneys."[6] This was the first motor-driven vehicle, so far as we know, ever constructed. Unfortunately it was weak, moving at only three miles an hour, needing constant refuelling because of its small boiler, and upsetting on the second test. Cugnot was driven into exile by the French war ministry, which had financed the project. When Napoleon came to power he brought the inventor back to France, gave him a pension, and urged a revival of the project. By failing to push it to a practical conclusion, Napoleon perhaps lost a chance to increase the mobility of his artillery, just as by failing to adopt Fulton's submarine he may have lost a chance to invade England.[7]

Although Watt in 1784 described a steam locomotive in one of his patents, he never pushed his conception beyond the paper stage. Boulton & Watt were concerned with the development of stationary engines; their models rapidly displaced the clumsy machines in the Cornish mines and were used in many types of factories. They were jealous, however, of any new developments which might affect their patents and the lucrative returns. William Murdoch, who later became Watt's chief assistant and grew famous as the inventor of gas lighting, had apparently hit upon the idea for a steam-powered vehicle about the same time as Watt himself. He made several small models, and the Boulton & Watt agent in Cornwall, where Murdoch was then employed, wrote his superiors of one of them that "it answers amazingly." The machine was of respectable size, its engine having a three-quarter-inch cylinder and a one-and-a-half-inch piston stroke. Boulton came down from Scotland and intercepted Murdoch as he set out for

London to patent his "road carriage." The employer dissuaded him from taking action, and returned with him to Cornwall to see a demonstration of the little machine. Boulton described the trial in a letter of September, 1886, to Watt. "He hath unpacked his carriage and made it travel a mile or two in River's great room, making it carry the fire shovel, poker and tongs. I think it fortunate that I met him, as I am persuaded I can either cure him of the disorder or turn the evil to good."[8] He effected a "cure," and he and Watt also checked for a time the development of the compound engine and opposed in general the use of high-pressure steam. They were quite self-righteous in protecting their commercial interests at the expense of the advancement of technology.

However, within a few years both Oliver Evans in the United States and Richard Trevithick in England were using high pressures for their "road engines." Trevithick completed a model in 1801, and an improved machine in 1803, both of which hauled heavy loads on a track. Soon other inventors produced locomotives that hauled coal and led to George Stephenson's Rocket, which in 1825 hauled cars on the first public railway, the Stockton & Darlington in Yorkshire. Meanwhile, early in the century William Symington in England and Robert Fulton in America had used Watt engines in successful steamboats.

The fascinating story of steam transportation has no full place in a volume devoted to another type of motive power, but the free steam carriage bears a direct relationship to the automobile, and the fact is notable that as a vehicle it was experimented with many years before the first rails were laid for locomotives. What is more pertinent, numerous British inventors patented "road carriages" during the first half of the nineteenth century. Had it not been for the determined opposition of horse-coach companies, railroad interests, the owners and users of horses in general, and timid pedestrians, steam-driven omnibuses and even steam-driven private carriages would soon have become common sights on English roads and the streets of English cities. It was in England at this time that industry, shop practice, inventors, and the requisite capital were all most richly found, and there good roads for steam-propelled vehicles were available. But Parliament by a succession of acts limited and repressed a growing movement, which might have given Great Britain world leadership in developing modern motor transport. Finally, by the Act of 1865, self-propelled vehicles were for-

bidden the highways unless each was preceded by a man carrying a red flag.[9]

Fortunately the steam-propelled vehicle in 1876 could freely use the roads of America, and thus fire the imagination of a boy in his thirteenth year. Had he been born in England twenty years earlier he would have been able to see steam omnibuses making runs with passengers, and even in 1876 the steam tractors and road-rollers produced in Britain were far superior to any vehicles in the United States. But what Henry Ford had seen was enough.

3.

The second event of that year 1876 for Henry was the receipt of a watch, probably a birthday present. It was his own: he could do with it what he liked. He wasted no time in taking it apart and putting it together again. Soon he knew in detail its parts and operation, and "by the time I was fifteen I could do almost anything in watch repairing, although my tools were of the crudest." When as a successful manufacturer he made this statement, he remarked: "It is not possible to learn from books how everything is made—and a real mechanic ought to know how nearly everything is made. Machines are to a mechanic what books are to a writer. He gets ideas from them and if he has any brains he will apply those ideas."[10]

Henry applied the knowledge acquired from his own watch in repairing timepieces for others. One of his diaries states that the first watch he "fixed" belonged to a neighbor, a boy named Albert Hutchins. Albert had a big chain on his vest, but the watch to which it was attached was not running. Henry looked at it, saw what was wrong, ground a shingle nail into a small screwdriver, and repaired it. The news of this feat quickly ran about, and the youth was soon busy putting ailing clocks and watches back into working order. He made most of his own tools. After seeing a mechanic at the Nickleson File Company in Detroit making files by hand, he made some small ones himself, using knitting needles. Often, he later declared, he walked to Detroit to get materials—screws, springs, and odd pieces of metal which he could pick up for little or nothing at various shops.[11] His zeal in such activity became proverbial. One neighbor was quoted as saying that every clock in the Ford home shuddered when Henry approached the house. He was once confronted by some of his com-

panions with a watch which they had taken apart completely; to their surprise he took the dozens of scattered parts and in half an hour had assembled them into a timepiece that ran perfectly.[12]

The experience of putting a watch or clock to rights was always exciting to the young mechanic; he learned something from each task, and that was reward enough. It was later said that William Ford remonstrated, telling his son that if he continued to do such work he should be paid for it; whereupon Henry carried on his unrewarded services by stealth, even slipping out of the house at night to pick up a watch or get parts.[13] His sister Margaret felt that while William Ford might have made such a suggestion, he would have been unlikely to press it, as he had long lived with the tradition that neighbors should help each other. Neither did she believe that Henry had slipped out of the house; "I never knew of him going out at night to get watches and bring them back to repair them."[14] In justice to Ford's own account, it may be pointed out that of course he would not want her or any of the family to know.

4.

The third event of this significant year was William Ford's visit to the Centennial Exposition of 1876.

It is difficult now to recapture the pride and elation which swept the country in connection with this great exhibition. The United States, if its birth was dated from the Declaration of Independence, was now one hundred years old. It was recovering from the disruption and ravages of the Civil War and from the worst of the 1873 panic; its recent industrial growth had been prodigious; its inventors had given the world the steamboat, the telegraph, the sewing machine, the cotton gin, the reaper, and many other devices, including the practice of using interchangeable parts in manufacturing. Americans had promoted the Atlantic cable and built the greatest railroad system in the world. From the time of the Crystal Palace Exposition in London in 1851, the interest in such events had been intense. An American World's Fair, using many British exhibits, had been held in New York in 1853. Americans had read with enthusiasm of successive fairs at Dublin, Turin, Hanover, London again, Paris (1867), and Vienna (1873). What better way to celebrate the nation's hundredth birthday than to

open on American soil a great exposition dedicated to progress, and particularly the mechanical accomplishments of man?

The idea was suggested by a number of Americans. John Bigelow, former minister to France; Charles B. Norton, United States Commissioner at Paris in 1867; John L. Campbell of Wabash College, Indiana; Col. Richards Muckle of Philadelphia—all were credited with roles in popularizing the proposal. Philadelphia, as the home of Independence Hall, seemed a logical site. Coolly received at first, the plan soon gained the support of important groups in Philadelphia, the state legislature, and eventually of Congress, which authorized the exposition, provided for a salaried Commission, and permitted the issuance of stock to finance it. This, with private gifts and appropriations by the city of Philadelphia and five states, realized a total of $6,724,000. Penn's city provided a tract of 450 acres for the site; thirty-eight foreign nations, including the colonies of France and Great Britain, agreed to exhibit; and the railroads of the nation offered reduced rates to the traveling public.[15]

The great exposition opened on May 10 and closed November 10. As William Ford would scarcely have visited it during the busy summer, he probably went in late September or October. He was accompanied by two neighbors, Horger and Leslie, and his young relative George Ford.[16]

William Ford, according to his daughter, was greatly impressed by the exhibits, and particularly by the machinery. In the ensuing months, he spoke frequently of all he had seen, and what he had to tell greatly interested Henry.

Machinery Hall alone, covering a space 360 by 1402 feet, the second largest of the exposition buildings, was a wonder-palace of mechanical exhibits. Central in it loomed a mammoth Corliss engine rising forty feet from its platform, with cylinders forty-four inches in diameter and 10,400 feet of shafting. It supplied power for almost all the many exhibits with moving parts. William could not have failed to describe this imposing machine. He could also have told his son of locomotives, hydraulic rams, fire engines, steam drills and lathes. In the English exhibit was a "steam road-roller," a self-propelled vehicle for surfacing roads. The contest for steam plows, held about the time of William's visit, would have led him to comment on such implements.

Had he shared any part of his son's enthusiasm for transportation

and power, or even had he been attracted by the unusual, William Ford would have noted another feature of the exposition—internal combustion engines using illuminating gas. Altogether there were seven. An American engine, the Brayton, was used to pump air for the aquarium; the German exhibit in Machinery Hall showed five models of the Otto & Langen gas motor, ranging from one-fourth to three horsepower; and a one-horsepower engine was used in the Main Building to operate a printing press for the London *Graphic*.[17] These gas engines, of course, were the forerunner of the gasoline motor.

5.

Because of the profound effect that engines of this general type were to have upon transportation throughout the world, and on the work and life of the boy who was just hearing of them, it is important to trace briefly their origin and development and define their nature.

A fundamental difference in character of course existed between the internal combustion engine of 1876—the "gas engine"—and the steam engines that up to this time had dominated the realm of power units. This difference is sharper today, but even though the Otto & Langen and the Brayton were primitive types, it existed in them and had existed since the first "gas engine" was conceived.

To understand this difference it is necessary only to note the overall character of the respective power plants. The steam engine required a furnace or other heating plant, a boiler for producing steam, and in addition the engine itself with its cylinders and pistons, valves, shafts, and other machine elements. The combustion of coal (or wood, oil, gas) produced no operative force of itself. It heated water, which in turn produced steam, the agent finally used. In contrast, the internal combustion engine was a complete unit in itself. Essentially, the fuel was fed into the cylinder, burned there, and by combustion acted upon the piston directly. No fire had to be lighted, no water heated. Starting and stopping were instantaneous. The engine showed no tendency to explode, a danger long present with steam units, and needed little watching in the course of operation. Even in 1876, although it was then relatively cumbersome and heavy, its weight and space requirements were modest in comparison with those of the steam engine.

In origin, the internal combustion motor was of fairly recent date. Some authorities trace it back to experiments with gunpowder as mo-

tive power late in the seventeenth century. To the extent that gunpowder is an explosive agent and the attempt was to drive a machine by a series of explosions, a theoretical link can be traced between the early experiments and the gas engine. But the gunpowder motors remained mere projects, for the fuel was not adaptable to engines. The effort to employ it was forgotten as the use of steam achieved its initial successes. Not until a full century later did the internal combustion motor really find a beginning in sound theory, and not until the 1820's did it emerge into even a stumbling operational life.[18]

The experiments and discoveries of Joseph Priestley and others beginning in 1774 furnishing a knowledge of the character and behavior of oxygen, hydrogen, nitrogen, and other gaseous compounds, undoubtedly promoted an interest in using "inflammable air" as a fuel, and proved eventually to have inspired a truly practical effort. As early as 1791 John Barber in England procured a patent on a proposal to employ such "air" for "the purpose of procuring motion." He envisaged a kind of gas turbine, which unfortunately was crude and impracticable. The patent of Robert Street, taken out May 7, 1794, is commonly accepted as the first suggesting an internal combustion engine. He proposed to generate gas from tar or turpentine, heating them in a receptacle from which the vapor would be drawn into a cylinder by the upstroke of a piston, which would also suck in a flame that would explode it. His theory had merit, but his machine was too faulty to promise successful operation.[19]

Meanwhile William Murdoch had developed an illuminating gas from coal, and this product remained for years the most promising fuel for internal combustion engines. The French engineer Philippe Lebon proposed to use it for the engine he patented in 1801, which was quite workable in conception. Lebon devised a cylinder and a piston working within it which operated a revolving shaft; he proposed the compression of the gas and its ignition by electricity, both these problems to be solved through the operation of the main motor shaft. His engine was two-cycle (that is, only two strokes of the piston were required to complete a full cycle of engine operation) and also double-acting: an explosion on one side of the piston would drive it in one direction, and a second on the other side would drive it in the opposite one—a practice adapted from the steam engine. Doubtless Lebon would have encountered many difficulties in developing his invention. The

quality of the metals employed was unpredictable; the capacity to machine them accurately was lacking; coal gas was not yet readily available, or of dependable grade; electricity was in its infancy; the problem of mixing gas and air in right proportions was still to be solved. Yet the Lebon design was admirable and he might have produced the first usable internal combustion motor; unfortunately he was assassinated in 1804, and it was almost sixty years before his essential design, still the best in the field, was represented at last by a working engine.[20]

Speculation, experiment, and even a limited amount of operation kept the internal combustion engine an active project among technical men for the next fifty-odd years. Claims for its use go back to 1814. The editor of the *Journal of the Franklin Institute* declared in 1828 that fourteen years earlier an inventor had given him a model; it used "inflammable air," he said, and "appeared to work with considerable power." Samuel Brown in England, who took out patents in 1823 and 1826, manufactured a gas engine which, according to Dugald Clerk, "was actually at work for some years, and was applied to a variety of purposes." Like most inventors up to this time, Brown utilized the vacuum created by combustion in connection with atmospheric pressure. Clerk declares that Brown built a "locomotive carriage" and "propelled a vessel with it [the engine] on the Thames," but difficulties of operation and the high cost of coal gas as a fuel halted his work.[21]

After Brown came William Barnett, the first man to comprehend the importance of compressing the explosive charge before igniting it and to invent a good igniting-cock. He and W. L. Wright in England, and Samuel Morey, Stuart Perry, and Dr. Alfred Drake in the United States, developed up to 1855 various features important to the mature internal combustion engine: water-jacketing for cooling the motor; better compression of the mixture; ignition by electricity, flame, and heated metal units; the right point of ignition (at the completion of the piston stroke); the fly-wheel to regularize and carry forward the impetus of the working stroke; and other features. While the British contribution was much the greater, American work was not negligible. Morey, who had been interested in steamboats, claimed to have developed a gas engine as early as 1820, using it in a boat called *Aunt Sally*, which he operated on Fairlee Pond in Vermont.[22] Perry and Drake prided themselves on their improvements in ignition, while the latter also perceived in 1855 the possibility of employing "liquid hydro-

carbons, as turpentine, naphtha, oil . . . of tar &c," and pointed out in a letter to the *Scientific American* that "the use of these products as fuel enables us to dispense with the gas, and the space they would occupy would be no more than *one-twelfth* of that required for coals." He foresaw light locomotives running 500 miles on a few barrels of fuel, and ships "making long and continuous voyages, even to China."[23] However, none of these American inventors shared in the more rapid development of the gas engine which was about to begin—a few years before the birth of Henry Ford.

In this period 1800-1855 various forces were working for the development of the internal combustion engine, and two against it.

Its predecessor, the steam engine, had rapidly opened the gate to a new industrial era. With the factories, locomotives, and ships it powered had come epochal improvements in all mechanical and technical fields. When Watt developed his first model, *no* reliable machine tools existed, and it was impossible to bore a cylinder with sufficient accuracy to permit its use—the first actually put to use was hammered into the final form. The metals necessary for machines were not produced in dependable quality or quantity to serve industrial purposes. No standardization of parts had been established, even for screws, bolts and nuts.[24] The steam engine created sharp new demands for quality and precision, and these were answered. Better raw materials, better standards of manufacture, better shop work, brought also many new inventions and processes which in turn provided new resources in tools, treatments of metal and other substances, and chemical and electrical knowledge, all immensely valuable. Inventors working with combustion engines had by 1855 rich mechanical and scientific resources that had not existed half a century before.

On the other hand, the steam engine tended to impose itself upon their thinking. True, they learned from it in fundamental ways—the use of pressure by heat in vapor form, the creation of a vacuum, the knowledge of cylinders, pistons, and shafts. But they also used devices applicable for steam engines and unhappy in the case of gas engines; for example, the double-acting feature which provided explosions on either side of the piston. This actually interfered with the efficiency of the motor. In general, they failed to see the gas engine as a mechanism having a behavior of its own and needing to be approached on its own terms.

In a similar fashion, the wide acceptance of steam created a certain prejudice against a new force, and an inertia with respect to it. Steam had done so much for man that he found it hard to believe anything else could do more! This was to be a characteristic of young Henry Ford, as we shall see. It characterized the age. Even when inventors were not steam-minded, investment capital, the buying public, and the technical journals were—for many years.

Nevertheless, despite such impediments the existing knowledge of internal combustion engines and the mechanical resources for constructing them were both sufficient to permit a notably successful achievement. The time awaited only a spark of genius, even of high resourcefulness, for the production of a fairly good motor.

Two Italian engineers, Eugenio Barsanti and Felice Matteuci, now made a definite contribution, although one that was chiefly theoretical. They worked on the principle that the explosive force of combustion should be fully utilized. The Italians, who took out English patents in 1854 and 1857, built a model employing a "free piston"—that is, the piston operated in a high vertical cylinder open to the air at the top and was permitted to rise without hindrance (being unattached to the crank shaft by any rod) and to use the full force of the combustion of gas beneath it. In doing so it forced up a working piston above it which turned a shaft by a rack and pinion device, and as the free piston descended, the working piston under the pressure of the atmosphere also came down, continuing the work. The burnt gases were then forced out through exhaust ports. On the return of the free piston a new explosion occurred and the cycle was repeated. It was a two-cycle operation, but the distance the piston travelled was greater than had been the case in previous cylinders.[25] Barsanti and Matteuci never manufactured their engine for commercial use, doubtless because certain details were faulty, but their work was soon to have an effect upon others.

The first motor to achieve commercial success did not, however, use their basic design. Jean Joseph Etienne Lenoir, a Belgian residing in Paris, who took out a patent on January 4, 1860, went back for inspiration to the Lebon two-cycle, double-acting motor of 1801. He soon added a carburetor for mixing liquid hydrocarbon to form a vapor, and had the advantage of better machining for his cylinder, piston, slide valves, and other machine elements, and better electric

mittee for Trade which passed on all patent applications and was doubtless a factor in the award of a patent on their gas engine (April 21, 1866). Although Otto and Langen did not feel that their machine was ready for commercial production, they entered it at the Paris Exposition of 1867. There happily Reuleaux appeared again—as a judge. He did not hesitate to point out to his associates how much better the Otto & Langen was than such competitors as the Lenoir and the Hugon, and it was awarded the gold medal![31]

Reuleaux was of course on sound technical ground in thus helping to reward his friends. With its free piston and long cylinder open at the top the German motor did not heat excessively, and while noisy in operation, it was actually quite dependable. Above all, its gas consumption, about forty cubic feet per horse power hour, was only half that of the Lenoir, or less, and represented in terms of Philadelphia gas of the 1870's a cost of about 5.7 cents per hour, actually less than that of a small steam engine.[32]

The Otto took hold slowly. In fact, several years of difficulty elapsed before Langen succeeded in 1872 in founding the Deutz Gas-Engine Factory at Cologne and began quantity manufacture. He was fortunate in employing Gottlieb Daimler as chief engineer. Daimler installed his former assistant William Maybach as chief of production, and the two quickly improved the machine. Without increasing the cylinder diameter they doubled the efficiency of the motor, reduced gas consumption sharply, simplified the entire unit, and made it more precise and reliable. They achieved an output of twenty-five engines per month by the end of the year, and in February, 1875, had raised the total to ninety. By that time 2000 motors had been made and sold in Germany, while the production by authorized agents in England was perhaps as large, one manufacturer alone having made 700.[33] It was engines of this type that were exhibited in Philadelphia in 1876.

The Otto & Langen was the first single-acting engine to achieve wide use. It now operated on about twenty-six cubic feet of gas per horse power hour, a cost only two-thirds that of a small steam engine. While cumbersome and noisy, it could be manufactured in small units of one-half horse power or more, and was much more compact and convenient than a steam unit. As it sold in increasing numbers, the knell of the steam engine as a unit for small shops had been clearly sounded.

However, the Otto & Langen had a formidable rival in the United

States and to some extent in England. This was the engine developed by George B. Brayton, an Englishman residing in Boston, who took out his first patent on April 2, 1872. After the discovery of petroleum in Pennsylvania, signalized by the well brought in by "Colonel" E. L. Drake in 1859, kerosene, gasoline, and crude oil had come into increasing use. By 1873 Brayton had substituted crude petroleum for gas, thus becoming the first to use this fuel for internal combustion engines.*

Brayton's motor was a two-cycle type, and like the Otto & Langen was single-acting. The petroleum was vaporized in a separate chamber, compressed, and fed into the bottom of the cylinder over a burning light which ignited it at once, so that it burned in a continuous flame. There was no explosion. The gas merely burned, activating the piston by heated air, as in the famous caloric engine of Ericsson. The motor was easy to start, relatively noiseless, and the consumption of fuel was claimed to be no greater per horse power hour than that of the Otto.[34] American observers reporting on the two for technical magazines in 1876 seem to have preferred the Brayton. In the *Scientific American Supplement* for May 27, 1876, appears a paragraph in an article, "Gas Engines," which rather amusingly reveals this attitude. "The Brayton machine," it runs, "is a fine piece of workmanship, and in its working is smooth and equable, resembling in all respects, externally, a well-proportioned steam-engine. [That predilection for steam!] The Langen & Otto engine, however, looks like any thing rather than it, and its action is widely different. When the charge is fired beneath the piston, the latter, with the rack attached, is shot upward with great velocity, descending slowly while in connection with the shaft, giving to it a very irregular and uncomfortable appearance, causing a kind of vague fear that the whole piston and rod or rack might be projected from the cylinder. After a little watching of it, however, this feeling wears off, and as the sudden impulses given the piston are found to recur with perfect regularity, one begins to have confidence in it, and to believe that this, as well as the Brayton machine, is an ingenious and creditable piece of work."

The favorable opinion of the Brayton held by such observers should be remembered, for it was to have far-reaching effects, both on the American automobile industry and on Henry Ford personally. Of

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* Lenoir had of course employed it, and Festugière had devised a cumbersome but efficient carburetor for liquid fuel. Still, general practice in France had been to operate with gas.

course, the Otto model at that time was the "atmospheric," free-piston, two-cycle engine. An improved and quite different machine, "the silent Otto," would soon appear, and in competition with this the Brayton quickly showed fatal disadvantages. In 1878, moreover, Dugald Clerk produced his first two-stroke or "Clerk cycle" engine, which by virtue of high efficiency achieved a great success in Europe and America.

Already, in 1876, when William Ford surveyed the wonders of progress at Philadelphia, an alluring new world of motive power was beginning to be revealed. It is possible that the Dearborn farmer brought a glimpse of it to his son. It is also possible that he may not have recognized its importance, already so clear to many American engineers. The celebrated Corliss engine, the other steam motors, the many machine tools, the extensive watch exhibits (the Waltham Watch Company showed in detail the manufacture of watches by machinery), wire-making, pin-making, and the Bell telephone, which so electrified the Emperor Dom Pedro of Brazil, would have been more obvious topics for his comments. Unquestionably, however, Henry received from his father's reports a sense of general excitement about the possibilities of the machine world. Here was the alluring area he had already longed to explore at first hand; and doubtless the news he heard of wonders at Philadelphia helped harden his resolve to leave the farm for this expanding area of new power. He was already enough of a mechanic to realize that he had touched only the outmost edges of the activity that so completely fascinated him.

6.

During the next three years Henry matured his determination to leave home and win a personal experience of the machine shops and factories of Detroit. He was finishing school and still specially interested in mathematics, but inclined to repair watches behind the sheltering wings of his geography, a book whose ample dimensions seemed specially designed for such operations.[35] He attended county fairs with his father, brothers, and sisters. He went happily to the circus when its tents arose every spring near Michigan and Wyoming Avenues.[36] He took produce to Detroit, and did a larger share of the farm work, as his mounting strength and years now made appropriate. This activity, of course, merely sharpened his desire to get away to town and the work he preferred.

Apparently he had not yet become much interested in dancing or the other purely social activities of the neighborhood. He and Edsel Ruddiman went to church Sunday nights. "Neither of us was very religious," Ruddiman explained years afterward, "it was more to be together and be doing something than to go to church." The two also rode horses that William Ford boarded for certain Detroiters, for the animals needed to be exercised.[37] Edsel planned to continue his education through high school and college. With Edsel and others Henry skated in winter, learning early and becoming quite proficient. But at times he took solitary walks about the countryside, particularly in the woods of the Ten Eyck estate and adjacent tracts bordering the Rouge to the east. "It was virgin forest," said his sister in 1951. "He liked that area."[38] These boyhood rambles perhaps had their part in his choice of the region as a place of residence more than forty years later. At home and school, a mischievous delight in practical jokes remained one of Henry's prime traits.[39]

More and more, Henry's inquiring mind and instinct to experiment involved him in a number of simple mechanical projects. In later years he said that he had a work bench in his bedroom at the head of the stairs,[40] and when the house was "restored," a bench appeared in that room. Margaret was positive that none had ever been there. "There was nothing upstairs except his dresser and a little stand he kept trinkets in, and his bed, of course." His tool bench was actually in the kitchen, she declared, near the east window; Jane Flaherty, then managing the household, was quite willing to have it there.[41] It is possible that on occasion Henry did some watch-repairing or other work upstairs on the little stand; but the important fact is that he had a tool bench and constantly used it.

One episode which Henry Ford mentions in a notebook suggests that he seized every opportunity he could to examine machinery and handle it. At fifteen he investigated a steam engine at the Dearborn sawmill —a Fulton, made in Detroit—choosing a Sunday when it was idle. He wanted to study the operation of a slide valve. Apparently he began to dismantle the engine and laid some of the units on a pile of sawdust close to it. One was a heavy cylinder. As he thrust his right arm inside the engine to find the steam ports and discover how the valve controlled the steam, the cylinder rolled down, pinning the arm tightly. He was trapped; though uninjured, he was unable to get free unless

he could remove the cylinder. This proved quite impossible with his left arm. But he perceived that if he could dig the sawdust away on the farther side, the cylinder might roll off of itself. He worked for half an hour, and finally cleared a trough into which the heavy unit slid. Then he continued his investigation of the engine![42]

Quite resolved to leave the farm and seek a job in Detroit where he could work with machines, Henry discussed his ambitions with his father. "I don't think there was any dispute at all," says Mrs. Ruddiman. "He [Henry] just gradually led up to the move he took." William Ford, she pointed out, was a quiet, kindly, understanding man. "We felt that we could go to father and talk to him, and things would straighten out. . . . When it was explained to him, he was reasonable."[43]

While this was undoubtedly true, it was also true that William Ford believed that a farmer's life in the United States was exceptionally independent, self-respecting, and satisfying. As a boy he had experienced the hardships and frustrations of tenantry; and his experience in Ireland had made him deeply appreciative of owning his own farm, and being able to save money against hard times. As a farmer he was also a public official—a member of two school boards and for years a justice of the peace. He read his New York and Michigan newspapers and discussed public affairs in the evening with neighbors like George McCormick and A. Horger. What more could a man desire? He was not able to gauge at their true value his son's rejection of agriculture and his passion for machines, for he regarded both as youthful feelings which a few years of experience would dispel. Henry Ford later described the situation in restrained terms when he wrote: "My father was not entirely in sympathy with my bent toward mechanics. He thought that I ought to be a farmer."[44] Thus on both sides there were deep convictions.

As the year 1879 advanced the time came for decisive action. Henry had now finished school. On July 30 he began his seventeenth year, an age then regarded as closer to maturity than it would be today. He had attained something like his full growth physically: he stood about five feet eight, and while slender, had a tough, wiry strength. Not only had his distaste for farm work increased, but the fact that his mother was no longer living lifted the last legitimate hold that he felt the home had upon him. "I never had any particular love for the farm,"

he told Edgar Guest in 1923. "It was the mother on the farm I loved."[45]

On December 1, 1879, he left the farm and went to Detroit. Some question surrounds the circumstances of his leaving. It is clear that he went without saying anything to his family, who discovered his absence only after he had gone; his sister admitted this. However, he never spoke of "running away," and Mrs. Ruddiman says that his father and the family knew that he was about to go, William Ford interposing no obstacle. The father, she states, was "sympathetic and understanding of Henry's desire to supplement his mechanical training and education with actually working in a shop."[46] Still convinced that his son's obsession with machinery was something he would outgrow, William perhaps decided that the way to cure the boy was to let him get a taste of shop work.

Mrs. Ruddiman points out that "it was not like Henry, either at that time or later, to move unthinkingly into a strange situation or to work with people he did not know." This is true; Henry would certainly have considered his movements well. Mrs. Ruddiman also thinks that William Ford arranged with the Flowers' machine works, operated by friends, for his son to work there. It is possible that William did, or was in process of doing so. But Henry did not go to the Flowers' shop; he went to the Michigan Car Company at Grand Trunk Junction.[47] Here he found employment in a plant which in 1884 was called the largest of its kind in the United States, and in 1879 was certainly the largest of all in Detroit. This fact may have had something to do with the youth's choice of a first employer.

he could remove the cylinder. This proved quite impossible with his left arm. But he perceived that if he could dig the sawdust away on the farther side, the cylinder might roll off of itself. He worked for half an hour, and finally cleared a trough into which the heavy unit slid. Then he continued his investigation of the engine![42]

Quite resolved to leave the farm and seek a job in Detroit where he could work with machines, Henry discussed his ambitions with his father. "I don't think there was any dispute at all," says Mrs. Ruddiman. "He [Henry] just gradually led up to the move he took." William Ford, she pointed out, was a quiet, kindly, understanding man. "We felt that we could go to father and talk to him, and things would straighten out. . . . When it was explained to him, he was reasonable."[43]

While this was undoubtedly true, it was also true that William Ford believed that a farmer's life in the United States was exceptionally independent, self-respecting, and satisfying. As a boy he had experienced the hardships and frustrations of tenantry; and his experience in Ireland had made him deeply appreciative of owning his own farm, and being able to save money against hard times. As a farmer he was also a public official—a member of two school boards and for years a justice of the peace. He read his New York and Michigan newspapers and discussed public affairs in the evening with neighbors like George McCormick and A. Horger. What more could a man desire? He was not able to gauge at their true value his son's rejection of agriculture and his passion for machines, for he regarded both as youthful feelings which a few years of experience would dispel. Henry Ford later described the situation in restrained terms when he wrote: "My father was not entirely in sympathy with my bent toward mechanics. He thought that I ought to be a farmer."[44] Thus on both sides there were deep convictions.

As the year 1879 advanced the time came for decisive action. Henry had now finished school. On July 30 he began his seventeenth year, an age then regarded as closer to maturity than it would be today. He had attained something like his full growth physically: he stood about five feet eight, and while slender, had a tough, wiry strength. Not only had his distaste for farm work increased, but the fact that his mother was no longer living lifted the last legitimate hold that he felt the home had upon him. "I never had any particular love for the farm,"

To serve such units and carry an increasing volume of passengers, some ten railroads had come into Detroit, several by ferry from the Canadian side of the river. Chief among them were the Detroit, Grand Haven & Milwaukee, which as the Pontiac & Detroit had received in 1830 the first charter of any road in Michigan; the Michigan Central, chartered in 1832 as the Detroit & St. Joseph; the Lake Shore & Michigan Southern, dating through the Erie & Kalamazoo back to 1833; the Great Western Railroad, a Canadian line, and the Flint & Pere Marquette. These and several lesser roads used either the Detroit, Grand Haven & Milwaukee station at Brush Street and Gratiot Avenue, or the Michigan Central station on Third Street. The Union Station was not projected until 1881, when a company bought a forty-acre tract on the river between Twelfth and Eighteenth Streets, built facilities, and after some years began to rent these to individual roads.[4]

Detroit nevertheless preserved much of its original character. Its relatively low buildings, none more than six stories, and the concentration of manufacturing and trade along the river shore had minimized the impact of industry. When the town had been laid out in 1807 after a disastrous fire, its planners had made the most of a striking and lovely situation. At the water's edge the tilled land and tree-shadowed houses had stood thirty feet above the stream, while the ground beyond rose in a series of scarcely noticeable ridges to a height of sixty feet a mile inland. Fine water views spread out in three directions. South and southeast across the clear Detroit lay the Canadian shore, and southwestward and then south the eye followed the broad river toward Lake Erie. Farther east lay Lake St. Clair, with the Ontario plain visible beyond it. Wooded islands dotted river and lake, while in all directions the tall forests of early Michigan and Ontario, broken by farms, made dark green borders for the blue expanses of water.

Midway in the 1830's the railroad had been built along the shore, but for years as seen from the river the town had an almost idyllic charm. "There is no other *de-troit*[strait] like it," wrote a lover of the city of its earlier aspect, "with its elevated shores lined with villages, villas, stately mansions, French farm-houses, windmills, and pear trees of more than a century's growth; its broad stream deep and clear and no *veto* 'sandbars' or 'snakeheads' to interrupt, and no fleet of 'Steam Tugs' or 'Lighters' to *aid* navigation." Thus declared Robert E. Roberts in 1855, when the original banks were being graded to the water

and the shore was already darkened with the smoke of trains and factory chimneys. By 1879 the industrial concentrations were much more obtrusive, and the old pear trees, of which only half a dozen had been standing twenty-four years earlier, some a foot and a half through and a hundred feet high, had disappeared.[5] So had most of the farms. Yet partly because of the plan of 1807 much of the look of old Detroit still remained.

This plan had been developed, after surveys and discussions with groups of citizens, by Judge Augustus B. Woodward, with the advice of Judge Frederick Bates and Governor Isaac Hull. Woodward had come from Alexandria, Virginia, and had been strongly influenced by the design which the French engineer and architect, Pierre Charles L'Enfant, had devised for the projected city of Washington in 1791.[6] The area which Judge Woodward covered was somewhat less than a square mile, but his plan was such that it strongly affected the future growth of Detroit.

The Grand Circus, a half-circle about a mile north of the river, and the Campus Martius (Military Square) about a half mile directly south of the Circus, were hubs from which various thoroughfares radiated. While Woodward Avenue ran north and south through these two hubs, other avenues approached them diagonally. Three—Michigan, Gratiot, and Grand River—were old territorial roads which ran to Chicago, Lake Huron, and Grand Rapids respectively. They cut across the rectangular criss-cross of most of the streets which lay parallel to the river or at right angles to it; and they and other avenues were extended in their original directions as the city grew. Michigan Avenue outside the city was long known as the Chicago Road.

The Grand Circus, which occupied an area of 500,000 square feet, and the Campus Martius, which covered 240,000, were planned as park areas, as were additional plots known as Center Park, Capitol Park, East Park, and West Park. For many years they were undeveloped, but work was finally begun in the 1840's, and the year 1879 found their once ragged and sometimes swampy surfaces lovely with grass, trees, flowers, and fountains. Meanwhile, seven more parks had been donated to the city; six were only from a quarter of an acre to an acre in extent, but Linden Park, presented in 1875, contained 25.70 acres. It lay beyond the eastern city limits, but only three miles from the new City Hall on the Campus Martius. The year that Henry Ford came to the

Michigan Car Company the municipality purchased Belle Isle in the river, three miles in length and about a mile wide at the broadest point, and began work (completed in 1882) to convert its 985 acres into the most beautiful of the city's parks.[7]

Many of the streets were broad—Washington, Madison, and Macomb Avenues 200 feet across; Woodward, Jefferson, and Monroe 120; Michigan and Cass 100. They were bordered by elms, maples, sycamores, and buckeyes, which with the spacious lawns and gardens of hundreds of residences gave the city north of the river district an air of repose and beauty. The houses were undistinguished in appearance; a few in the old colonial style remained, but most of them were severely rectangular, their fronts broken with bay windows, haphazard turrets and gables, or adaptations of the more recent Mansard style. Iron picket fences surrounded most dwellings, and iron gates opened upon flagstone sidewalks, which were tilted by the winter contraction and expansion of the earth so that they gave precarious footing on dark nights. Many streets were paved with cedar blocks, the interstices of which were filled with gravel and tar. In 1883 the city had eighty miles of wood-paved and twenty of stone-paved streets. The blocks were at first excellent, but they tended to expand when wet by rains, loosening sections of the surface.

"On pleasant summer evenings," says one observer of old Detroit folkways, "rugs were placed on the stone front steps and people sat out through the long twilight. Neighbors could see and hear one another on their steps and there was a good deal of visiting back and forth. About nine-thirty the neighborhood young people would go to the corner drug store for an ice cream soda. Then it cost five cents."[8] Henry Ford, as we shall see, was working nights, and if he was aware of these pleasant habits and hours was too busy and too poor to share them.

Detroit at this time had about twenty miles of street railways, horse drawn, and a fairly good system of street lamps, a little more than half of them burning gas, and the remainder naphtha.[9] The city had ample telegraph facilities, the beginnings of a telephone network,[10] a waterworks that drew ample supplies from the Detroit River and pumped it through pipes to the townfolk, a police department with 160 policemen and officials, and a fire department with thirteen steam engines and a force of 142 men.[11] The once uncrowded river was now

a highway for thickening traffic. "In every direction," wrote Roberts in 1884, "are seen the white-spreading sails, floating steam palaces, steam barges, tugs with long tows of vessels; the jaunty, swift-plying private steam yachts, the boat clubs' gigs and sculls, and the ancient canoe."[12]

The restaurants of Detroit were numerous, and the best had long enjoyed a good reputation. They could no longer freely supply the venison, wild duck, pheasant, and other delicacies once so abundant, but food was cheap and plentiful, with excellent fish from the lakes. H. R. Schoolcraft had made eloquent rhymes about the whitefish:

So fine in a platter, so tempting to fry,
So rich on a gridiron, so sweet in a pie,
That even before it the salmon must fail,
And that mighty bonne-bouche, of the land beaver's tail . . .
Its beauty or flavor no person can doubt,
When seen in the water, or tasted without.

The city had plenty of hotels, some elegant, some simple, some wretched; taverns that made a specialty of visiting farmers and their horses; and numerous boarding houses for workers. Its spiritual and cultural life, though not distinguished, was by no means a meagre one: it had many fine churches; a public library with 60,000 volumes and various semi-public libraries; two medical colleges; five daily newspapers and other periodicals; and four theatres—Whitney's Grand, White's Grand, the Detroit, and the Park. These theatres, accommodating 5000 spectators, carried on a tradition that had brought Edwin Forrest, Charlotte Cushman, Junius Brutus Booth and the celebrated Edwin Booth, the senior Hackett, and many other distinguished players to the city.

2.

According to his sister Margaret, Henry at first went to stay with his aunt, Rebecca Ford Flaherty. Soon he apparently moved to 452 Baker Street.* William Ford, said Mrs. Ruddiman, did not worry about his son's whereabouts, but on his next trip to town looked him up.[13] It is not clear what his status was at the Michigan Car Company. He

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* The Baker Street now shown on the map of [illegible] of where the works were. [illegible] miles from th[illegible] Baker Street [illegible]

was paid $1.10 a day, more than an apprentice. But we know more about the plant than the employee's relation to it, and can describe in some detail the place in which the boy began his life with the machines.

The company occupied thirty acres of ground in Springwells, just outside the city to the west, the main works lying in a triangle formed by the junction of the Michigan Central with several other roads.[14] The MacMillans and Newberrys both held important interests in the firm, the former being dominant. According to a reporter whose description seems to date from 1877, the plant comprised a number of buildings, carefully separated to minimize the fire hazard. They included a machine shop, a wood-working shop, an assembly shop, and probably a foundry and other units, although these are not mentioned in the otherwise clear account. About 1900 men were employed in the buildings and the yards. The establishment was big, complicated, bustling, and as efficient as its managers could make it; just the place to learn how important machine work was done under pressure. And the work was organized on what then seemed progressive lines. It followed a plan that provided a crude assembly line.

"Everything goes in one direction," ran the account. "At one end of the yard are the materials. The wood leaves the lumber pile, is shaped in the woodworking shop, and arrives at the setting-up [assembly] shop. The iron at the same end of the premises divides into two streams of completed work—one being the wheels, and the other soft castings. Both streams, however, unite in the machine shop, and from there the wheels, trucks and other iron parts meet the wood in the setting-up shop, and are united in completed cars, which are pushed forward, still in the same direction, to the paint shop, where they receive the finishing touches, and emerge from the other end of the premises ready for the rail."[15] Thus the boy of less than seventeen was introduced to the idea of routing a product from point to point, using successive sets of workmen. When more than twenty-five years later he planned a process of manufacture that became known around the world, the Michigan Car Company may have exerted a conscious or unconscious influence.

The reporter watched with particular interest the work in the assembly or setting-up shop, a roomy building 200 by 80 feet, with four railroad tracks running its full length. "The wheels are placed on the rails, the trucks adjusted, and the carpenters, with every piece of lum-

ber and every iron rod, nut and door slide of mathematically correct dimensions, swiftly place them together. The writer was at this building at 11 o'clock in the forenoon, and already the laborers were finishing along the track four completed cars, the materials of which at 7 o'clock were mere piles of timbers, boards, castings and wrought iron." Such a schedule would mean about ten cars a day, or somewhat less than the 4500 per year credited to the Company in 1883. Later it was to turn out 10,000.[16]

We do not know in what part of the works Henry Ford was employed; the machine shop seems the most probable unit. He stayed with the company only six days. W. J. Cameron later described the incident which led to his leaving. "He told me . . . something went wrong with some of the machinery, and he intuitively saw what was wrong—after the men, the practised mechanics, spent most of the day trying to fix it. He shyly kept away while they worked on it, and later he went in and fixed it. The foreman looked at this smart young guy and fired him. The boss [i.e. Henry Ford] said, 'I learned then not to tell all you know.' "[17] Another account says that young Ford quit in order to avoid discharge: "Unfortunately he had riled the older hands by using only one half an hour to make repairs that ordinarily required five hours."[18] Ford's own version in one of his notebooks is almost telegraphic: "I went to Detroit Dec. 1, 1879 To carshop 6 days Got into trouble babbiting a box Will tell." (Unfortunately he never did!)[19]

The young worker was back where he had started, but he soon found employment at the James Flower & Brothers Machine Shop. This plant was situated at Woodbridge and Bush Streets, two blocks north of the Detroit River and about a mile southeast of the city hall. It is quite possible that William Ford had prepared the way, that Henry knew the door was open, and that when he lost the job at the Michigan Car Company, he merely went over and began work. The magnitude and variety of the car plant had probably led him to go there first; now he had no reason not to join the Flowers, whom he knew personally.

The Flower firm had been organized in 1852, with James apparently the leader. He and his brothers George and Thomas, all born in Winchester, England, had worked as mechanics on the Michigan Central, where William Ford may have known them. They had occasionally visited at the Ford farm, and got fresh produce from it.[20] The three-

story building they occupied, almost half a century old when they began to use it, was said to have been the first brick structure erected in Detroit after the fire of 1805. In 1879 it contained a foundry, probably on the ground floor, where brass and iron castings were made, and shops where the products, chiefly valves and fire hydrants, were finished.[21] It was one of the smaller factories of the city; and to a young hand who knew the managers, it probably offered better opportunities for a comprehensive training than most of the larger plants.

Henry Ford and his sister Margaret both speak of his "apprenticeship" in Detroit,[22] and it was doubtless in the Flower shop that this began. The proprietors represented the English tradition of thorough workmanship. Unlike the Michigan Car Company, they would not have paid $1.10 a day to an inexperienced youth, no matter how talented, but would have insisted upon training him at the low wage paid to beginners.

We have some idea of the general character of this training. John Flower, as one of the partners and the president of the Flower Valve Company, which succeeded the original firm after the partners died in the 1890's,[23] worked in the shop in the days when all three of them were active. In 1921 he spoke feelingly of its high standards: "A man was trained to draw his blueprints for a job, and, if necessary, make his patterns, mould his piece, finish and install it." David Buick, William Purdy, Anthony Weber, and Alex McKay were all trained in the establishment; and they all became noted as manufacturers, inventors, and employers of real distinction.[24] John Flower's comment is of interest as bearing upon one somewhat controversial point respecting Ford. When Henry became a successful manufacturer, he disliked poring over blueprints, demanding small scale models instead. In the face of much evidence to the contrary, some critics freely asserted that he could not read a blueprint. But it is evident that if he went through any considerable part of the training on which the Flowers insisted, he learned both to make blueprints and to use them.

Because of his apprentice status, Henry in 1880 was paid only $2.50 a week. He had found room and board with Mrs. James S. Payton at 452 Baker Street, probably when still at the Michigan Car Company's works, which were not far away. As his bill at Mrs. Payton's was $3.50 a week, he earned a dollar less than his barest expenses. Apparently he stayed on at Mrs. Payton's, using the streetcar or walking several miles

to the Flower plant; but he at once cast about for means of filling the gap between outgo and income. He heard that the McGill Jewelry Store at 444 Baker Street, a few doors from his lodgings, had acquired a large stock of clocks from another store that had failed. Henry walked in and offered to clean and check them. McGill, satisfied as to his competence, paid him fifty cents for an evening's work. However, he would not let his new helper work on the repair bench near the store window for fear that the public would distrust so young a worker. When the youth had almost finished with the clocks, he took a bold step.

"One night," William A. Simonds quotes him as saying, "I went to work on the watches waiting for repairs. Mr. McGill was alarmed when he first learned about it, but after he examined the watches he was pleased. So pleased that he gave me a steady job. But he was afraid his customers would not approve of a boy repairing their valuable watches, so I continued to work at the bench in the back room, out of sight."

Years later Ford had a similar bench installed in Greenfield Village. He found some of the instruments he had used at the McGill shop, and acquired others of the correct type to complete a full set of tools for the McGill store, which he had purchased and removed to the Village in 1940. He signalized its installation there by repairing the watch of one of his father's hired men, Adolph Culling; a timepiece he had obtained from Culling's descendants because, he said, it was the first watch he had ever handled. A bystander who observed the seventy-seven-year-old Ford at this task remarked that since he lacked a jeweler's glass he seemed not to be the complete watchmaker. "I never used one," retorted Ford, "and I don't have to use one now!" In a few minutes the ticking of the repaired watch announced the truth of his declaration.[25]

Henry worked nights at McGill's for $2.00 a week, thus giving himself a margin of a dollar a week over his board and lodging.[26] He might well have considered his life hard, but apparently he never thought it so for a moment. Rather he seems to have felt that he was enjoying exceptional opportunities for self-development, for he was learning both by day and by night. "I was never tired," he said years later. "I was always enjoying what I was doing, and always had plenty of energy for it."[27] He remarked as a man of sixty, "No work is ever

hard," and declared that a man ought to dream of his work day and night. "If he intends to remain always a manual laborer, then he should forget about his work when the whistle blows, but if he intends to go forward and do anything, the whistle is only a signal to start thinking. . . . The man who has the largest capacity for work and thought is the man who is bound to succeed."[28]

In spite of his day-and-night schedule, Henry still had time for thinking, and for some diversion. As for reading, a brass finisher named Samuel Townsend had recently come from England, and had brought a magazine called *English Mechanic and World of Science,* which he lent to the apprentice. In this Henry read about the gas engines that had been developed by Dr. N. A. Otto and that had been exhibited at the Centennial Exposition. The improved Otto engine was patented in the United States in 1877, and soon afterwards manufactured here.[29] Henry Ford always remembered reading the English magazine, mentioning it both in his testimony in the Selden Patent Suit in 1904 and in his autobiography. He had no perception at the time of the great future that the Otto engine would inaugurate. "It ran with illuminating gas, had a single large cylinder, and the power impulses being thus intermittent required an extremely heavy fly-wheel. As far as the weight was concerned it gave nothing like the power per pound of metal that the steam engine gave, and the use of illuminating gas seemed to dismiss it as even a possibility for road use. It was interesting to me only as all machinery was interesting."[30]

Nevertheless, Ford later wrote: "I followed in the English and American magazines which we got in the shop the development of the engine and most particularly the hints of the possible replacement of the illuminating gas fuel by a gas formed by the vaporizing of gasoline." He added that the gas engines "were received with interest rather than enthusiasm," and that no one expected more than a limited use for them. He himself "followed its progress, but only from curiosity."[31] Probably his interest was definitely less than he later described it, for after the coming of the automobile he had various reasons for wanting to believe, and have others believe, that he had manifested an early curiosity about the internal combustion motor. When in 1882 he turned to engines, it was the steam types which interested him and provided him with a livelihood, and when he thought of power at any time

during this period, especially for locomotion, he undoubtedly thought of steam.

Henry left the Flower shop at the end of nine months, in the late summer of 1880, seeking more experience.[32] "In the Detroit shops we had to serve as apprentices for four years," he recalled later. "Only a few boys could get into each shop at a time and when we did get in the men showed us how to do a few things very well. That's why I changed; so that I could learn more about different things."[33] He moved on to a firm where he would work out his apprenticeship, keeping the status he had held at the Flower plant, and even accepting at first a loss of fifty cents a week.[34]

His new place of employment was the Detroit Drydock Company, the largest of Detroit's shipbuilding firms, whose plant was at the foot of Orleans Street on the Detroit River. The company had been established in the early 1850's, but under a different name. After several changes in ownership and title it was incorporated in 1872 under the above designation, with John Owen, for some years previously a partner, as president, and Frank E. Kirby as consulting and construction engineer. Its Detroit yards had two docks and a seven-hundred-foot frontage on the river. An illustration published in 1884 shows a ship in each dock and a third on rails to the west, with a large building between the docks which might be a machine shop. In the rear are an office, an iron and brass foundry, an engine works, a hotel, and a boiler shop—all labelled. At Wyandotte the company owned other docks, with a saw mill, carpenter shop, boiler shop, and smith and machine shops. The two plants, which employed more than six hundred men, were busy chiefly in building vessels, "either of wood, iron, or steel," although they also repaired ships and boats. Their business was a growing one; in 1879-84 they constructed a total of thirty-six vessels, as against thirty-four in the twelve years previous. Steamers, barges, barks, schooners, tugs, steam ferries, and car barges were made,[35] and for many of these craft the company designed and built engines ranging from 600 to 3500 horsepower.[36]

In retrospect, Henry Ford apparently thought of the Detroit Dry Dock Company as the plant where he got his training as a machinist. In *My Life and Work* he writes as if he went directly there from the farm, mentioning no other firm, and it is the only plant of this period cited by him in his testimony in the Selden Patent Suit. It was of course

the last place at which he worked as an apprentice, and he stayed there perhaps three times as long as at the James Flower & Brothers' shop.

The most colorful figure in the Dry Dock Company, very important in all its activities, was its consulting and construction engineer, Frank E. Kirby. Then thirty-one years old, a graduate of Cooper Institute in New York, he had had experience in the East. Already he had built the Wyandotte shipyard for Eber B. Ward, and had been designing engines and vessels for the Detroit Dry Dock Company, with which both his father and brother were associated. Apparently he kept a quasi-independent status, working for the Detroit Shipbuilding Company and others, although in 1880 he may have been devoting himself entirely to Dry Dock Company affairs.[37] Henry Ford one day had a fleeting contact with him. The young apprentice was pushing a heavy load in a wheel-barrow up a steep incline into a ship, keeping his feet with difficulty. Kirby, passing by, noted the struggling youth and called out to him: "Stick in your toenails, boy, and you will make it!" The remark stayed in Ford's mind. During the First World War he summoned Kirby to build Eagle boats for the Navy, and told him of the episode. "I have been sticking in my toenails ever since," he remarked. His opinion of the marine engineer was high; and either as a tribute to his skill, or an indication of his influence upon the Ford career, Kirby's name appeared above the portals of the Engineering Laboratories Building at Dearborn many years later, along with the great scientists and inventors of the world!*

At the Dry Dock Company young Ford was employed in the engine works. From his point of view this must have been a happy circumstance, for he acquired first-hand experience of various types and sizes of power plants. In 1916 he told of an incident which marked his term there. "I had cleaned up and was sitting down," he recalled, "enjoying a minute's rest as only the man who has earned it can enjoy rest, when John Donaldson, the foreman, came through. He looked at me and grinned at my attitude of careless relaxation. Some of the men had

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serious injury.

been lazing just as I was, had sprung to attention and tensity as they saw the 'boss' approach.

"'That's right,' he said to me. 'Make no pretense because I am the boss. Sit there and smile at me. I'd rather you'd do that than make a bluff at working just because the boss is passing.'"[38]

The youth had no particular difficulties during this preliminary period. "I passed my apprenticeship without trouble—that is, I was qualified to be a machinist long before my three year term had expired," he declared in 1923.[39] Although his wages were probably soon raised, for some time he continued to repair watches.

His knowledge of watches had become wide and detailed, and although he was not yet twenty he was speculating on the possibility of putting it to creative use. "I thought that I could build a good serviceable watch for around thirty cents and nearly started in the business. But I did not because I figured out that watches were not universal necessities, and therefore people generally would not buy them. Just how I reached that surprising conclusion I am unable to state. . . . Even then I wanted to make something in quantity."[40] According to one biographer, Ford calculated that if he could turn out 2000 watches a day, the thirty-cent cost would be possible. He started to design machinery, working at night with a vise clamped to the window sill of his room at Mrs. Payton's. A young schoolteacher in an adjoining room complained of the noise, and he had to stop. Still, he went on planning, procuring a partner, and then became daunted by the task of disposing of the 2000 watches a day—600,000 or more a year,[41] and gave up the project.

3.

Henry Ford apparently left Detroit some time in 1882. In 1904 he said that he left "about 1883," but in one of his diaries he seems to set the date somewhat earlier, and his sister Margaret and Marvin Buckberry both give it as 1882. Buckberry says it was "early" in the year; the time may have been spring, for the likelihood is that he worked in the vicinity of Dearborn for some time that summer.[42] His grandfather Patrick O'Hern had just died; his sister Margaret was now in full charge of the household.

William Ford wanted Henry to return, and perhaps expected to find his son tired of shops and ready to become a farmer. Henry left his

boarding house in Detroit and made the farm his postal address and a residence between jobs. But apparently he did not work on it for at least a year, and he was never to do so again regularly. His brother John, now eighteen, and William, twelve, could give his father all the help that was needed. The *Ford News* for September 22, 1922, may give a clue to what happened. In an article, "State Fair Crowds See Greatest Ford Exhibit," it is stated that next to a McClure thresher of 1843 was "the thresher of later date, operated by steam engine No. 345 of 1882, which was built by the Westinghouse Co. of Schenectady, New York. In 1882, it was stated that Mr. Ford operated this engine for 83 days, for a prominent Dearborn farmer." This man was John Gleason, who had a small farm in Redford township. Margaret Ford Rudiman believed that it was through Gleason, while working for him, that Henry met John Cheney, state or district representative of the Westinghouse Engine Company of Schenectady, who employed him to service the engines of various farmers in southern Michigan.*[43]

We have from Henry Ford a sworn statement that not long after leaving Detroit he was employed by the Westinghouse Engine Company as an expert, and went on the road, "setting up traction engines." He did this, he says, for about a year. Ford explained how the Westinghouse, like the Nichols, Shepard machine, could travel under its own power, and then by a change of belts could be used for threshing or sawing wood. He stated that he dealt with about twenty of these Westinghouse engines while working for the company in southern Michigan.[44] Mrs. Ruddiman remembered that "my brother travelled around quite a bit during this period," although she thought that he operated engines and did not do repairing. But Ford's own testimony is precise on this point; he was an "expert." It is possible that between his jobs with steam engines Henry was busy helping his father with farming. An item in the Detroit *Free Press* for November 20, 1883, states that "Henry Ford, driving a horse drawing a manure wagon was seriously injured about 4 P.M. on Sunday, November 18, by the animal running away and collapsing the wagon. The horse was stopped by a fence." But it is by no means certain that this was Henry Ford the future industrialist, for he had two uncles of that name on neighboring farms.

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* That Henry worked on the Gleason farm was confirmed in 1952 by Fred Gleason, John's nephew. See his *Reminiscences*, Ford Archives.

It is possible Henry may have worked also at one or more plants in Detroit during these first three years after his apprentice work. We have a letter apparently written to him by a fellow worker, dated January 14, 1884, but unsigned. It throws a limited amount of light upon his associations—enough to justify quoting it:

> Dear Friend
>
> I suppose you think I was never going to write to you I have been rasseling the cros cut Saw most of the time since I been hom I think I would a little rather rassel a screwdriver and nippers I wrote to roehm but have had no answer yet I wish I was in there to work I suppose you and your mash tripped the lite fantastic toe newyears night. I was down to the rink newyears and skated a rooler clean off of my skates take a look around roehm and writes and see if they are busy this is all at present Old chum
>
> Write soon[45]

This short communication brings a welcome breath of humor and liveliness into the story of a young man who might otherwise be thought of as rather painfully dedicated to his machines. It is clear that in the previous months he had gone about with a companion who liked to have a good time.

Another letter to Henry surviving from these years came from a young woman nearly his own age, a second cousin, Mary Catherine Noble. Her mother had been Rebecca Ford, a first cousin of William Ford, and had married William Noble, one of the Scotch Settlement farmers. Noble had been born in Aberdeen in 1817, and in recent years apparently had removed to Detroit.[46] Henry knew the Nobles while working in Detroit, and was on close terms with them in 1884. In Mary Catherine's communication we get a glimpse of several sides of the young man not previously in evidence.

> 64 Sibley St., Detroit,
> November 17, 1884.
>
> Dear Henry,
>
> You remember what I said on Sunday, and now I want to ask you again to be sure and not lose this chance of hearing Mr. Moody. You will probably never have another one.
>
> And Henry perhaps you will get helped there, as you may never be if you stay away. And just think how much better it will be for you to go to a little trouble to come in and do all *you* can to be led into the right way, than to just let it go by and perhaps never come into the band of soldiers for

Christ. For, as Mr. Brown said on Sunday, the Bible is true and if so than Christ is the only way by which we can be saved.

I am so glad you are going to college. An education is a good thing to have. A man is of so much more account in the world if he has one.

And that is partly the reason why I am so anxious to have you come in next Sunday night. If you begin your studying as a Christian, then you will do your work with more satisfaction, as it will be with a more definite end in view. I tell you Henry, an educated, Christian is one of the grandest objects on the face of the earth.

Another reason why I want you to come to the meeting is so that John will come too. You are your brother's keeper, and it seems to me as you are older than he is and have stronger principles, you are some what responsible for him. Please have him too. If not him, then some body else.

The meeting is at White's Theatre on Randolph St. at half past seven. You ought to be there by or before seven at least. Be *sure* and be there early. Brother Jame[s] and Jame[s] Ruddiman are coming in.

We would like to have you come here and see us when you come in to school. Where are you going to stay. There is a young man here who used to go to Goldsmith's and who wants a room mate. He has a very pleasant room and is a good young man too. Unless you have some other place I wish you would come here. I think it would be pleasant for you and for us too.

Please come in Sunday night and bring John too. There will be fine singing too.[47]

Your true friend, M. C. Noble.

Mary's fervor for religion was characteristic of worthy young women of her day, and her devotion to Dwight L. Moody did not indicate any extreme attitude, for Moody's preaching stressed faith-by-works and the positive side of Christianity in general. As for Henry, he had apparently shown enough interest in religion to make his cousin believe that his faith could be strengthened. In later years he told W. J. Cameron that as a youth he had gone to many Detroit churches with the feeling that he might find some creed that would mean more to him than any had as yet, but that he had ended this experiment in much the same state in which he began it.[48] His sister Margaret said that the family's attitude toward church was liberal; the children often went to other places of worship than their own.[49]

Henry appears in Mary Catherine's letter as a young man of character: "you are older than he is and have stronger principles," and he also appears as one who was still trying to improve himself by further

education. This was not "college" in the proper sense, but a school for commercial training. The Goldsmith, Bryant & Stratton Business University was located at 143–153 Mechanic's Hall, Griswold Street, Detroit, not far from City Hall. Its advertisement in the 1882 Detroit Directory shows that it taught bookkeeping, business transactions of various types, shorthand, and typewriting. One of a chain of so-called Bryant & Stratton Colleges, it had been established in 1857.[50]

We have no clear evidence as to Henry's reasons for wanting business training, but it may be assumed that already his mind was busy with plans for enterprises of his own, such as his watch manufactory, and he realized that something more than mechanical proficiency and ingenuity would be needed. In other words, he already hoped to manufacture and sell as well as invent, and felt that this particular time, when he had work for summers but not winters, could well be devoted to training for future operations. He attended Goldsmith's, although we do not know how long or with what results. Two and a half months after he received Mary Noble's letter there came another from his friend and former fellow worker, again unsigned, and dated February 4, 1885, which is worth quoting in part:

> Dear friend
>
> I received your letter and was glad to hear from you I have quit the wrastleing business and gon in to bottoming chairs since the snow came which I find much easier and not quite so much preashure on the arm . . . I had a letter from Roehm about to weeks ago he said they were enable as
> [illegible] ave rote him since that if there was no
> [illegible] ld like to know as i would have to look
> [illegible] myself in readiness to come to him at
> any time [illegible] ill go in to
> [illegible] ent hoping
> [illegible] your head

The chum's letter confirms Henry's attendance at the business college, and indicates that steady work of the kind they both wanted was not easy to get. Henry Ford apparently still had a connection with the Westinghouse Engine Company. On August 4, 1885, he and John Cheney were employed by the firm to assemble a ten-horsepower engine, No. 739, at Milan, Michigan.[51] At some time during this year he also repaired an Otto engine at the Eagle Iron Works in Detroit. Buckberry notes that he made the repairs "and also studied the mech-

anism." Ford himself in 1904, when cross-examined on August 9 in the Selden Patent Suit proceedings, testified that he saw such engines repaired and "did some work on them" at the Eagle works.[52] Thus he seems to have been getting such work as he could, but not so much as he would have liked. Apparently in the summers, when not employed by Westinghouse, he continued to operate an engine for Gleason.[53]

He was now twenty-two, and ready to put his energies into a job or a project that suited him. He had a social life, with both men and women friends. He may have felt a transient interest in his cousin; she seems to have had one in him. Mary Catherine married in 1893, at the age of thirty, and as Mrs. Bell bore one son who became a doctor. Her earnest, lively personality lights only a moment of the Ford story, but it tells us something of the companionship young Henry Ford knew as he was completing his apprenticeship for a larger life.

VI

THE BROADENING STREAM

OPERATING or repairing steam engines in the summer, finding occasional work in a Detroit factory in the winter, overhauling his father's farm implements and lending a reluctant hand with other farm work, Henry Ford in 1884 was restlessly looking for some opportunity in the machine world that would satisfy his instinctive demands. According to his later declaration, he was also vaguely pondering the problem of a horseless carriage. In various parts of the United States other young men, most of them destined to affect the career of the Ford Motor Company, were groping toward a satisfying activity.

In a little Illinois town Charles E. Duryea had turned from the farm to establish a bicycle shop. Not long before he had written a high school graduation thesis on "Transportation other than rails," in which he predicted that a flying machine would eventually cross the Atlantic in half a day![1]

In Dayton, Ohio, a mechanic named H. K. Shanck was making tricycles and trying to develop a gasoline engine to drive one. Two years later, at the Ohio State Fair in 1886, he exhibited a model that used liquid fuel and employed electric spark ignition; young Duryea saw it and soon became haunted with the vision of a gasoline motor wagon.[2]

In 1884 Elwood Haynes relinquished his principalship of the Portland, Indiana, high school to set out at twenty-seven for Johns Hopkins, where he would study science and engineering. He had already invented a process for producing tungsten chrome steel.[3]

In Cleveland, Ohio, the sturdy, twenty-four-year-old Scot Alexander Winton had just taken a job at the Phoenix Iron Works. He would soon leave this work to begin making bicycles, and still later devise a horseless carriage.[4]

At Lansing, Michigan, Ransom Eli Olds, aged twenty, was helping

his father design a gasoline engine, which they would begin to manufacture in 1885 at Pliny Olds' machine shop on River Street. Familiar with steam engines, young Olds would soon adapt one to a tricycle.[5]

In Detroit, sixteen-year-old Charles B. King, the son of a retired general, was attending preparatory school, working vacations in machine shops, and planning for an engineering course at Cornell.[6]

These were only a few of hundreds of Americans who made part of the broadening stream of mechanized industry that was already moulding American life and soon would dominate it. Some, like Henry M. Leland, were developing high precision skills in the better shops and factories; some, like John and Horace Dodge, were young machinists moving from plant to plant; still others, like W. L. Grout, were to be found in sewing machine works; or, like W. A. Patterson and the Studebaker brothers, in carriage manufactories; or, like Thomas B. Jeffery, in bicycle-making establishments.[7]

All these Americans shared the excitement of a surging industrial growth and the faith in rapid mechanical progress which quickened the pulse of the nation and the world. They had seen new machines appearing almost daily, new methods developing with or without the machines, and rich industrial empires arising—railroads, oil, steel, structural engineering, telegraphy, and the more specialized manufacture of typewriters, sewing machines, firearms, power pumps, and bicycles. They had abounding confidence in the future—a dream of industrial miracles. Yet so rapid had been the probing experimentation that already, both in America and abroad, accomplishment had outrun common knowledge. All of these restless men were ignorant of many outstanding occurrences, some of which must now be related.

2.

These developments had been chiefly in the field of gas and gasoline engines and in the use of such power units in vehicles.

The progress of steam road carriages had been noteworthy even though it offered little practical result. Richard Dudgeon's operable vehicles of 1856 (exhibited at the Crystal Palace in London), and 1860; Dr. J. M. Carhart's steam buggy of 1871 at Racine, Wisconsin; a model built at Green Bay, Wisconsin, in 1875, in response to an offer of a $10,000 prize made two years earlier by the state—this model making

a 200-mile run and achieving twenty miles an hour on a good road;* the De Dion, Bouton, and Trepardoux models in France; John and Thomas Clegg's four-wheeled steam car of 1884, the first self-propelled vehicle in Michigan—some at least of these models must have come to the attention of men like Haynes, Duryea, and Olds, if not to that of Henry Ford. But the work of European inventors with gas and gasoline engines and vehicles was far more significant.

This work takes us back first to Joseph Etienne Lenoir, producer of the first usable gas engine. In 1860, the very year in which this model had become known, Lenoir had designed a carriage to be propelled by it. This, as described in *Le Monde Illustré* of June 16, 1860, with a pictorial representation of the vehicle, comprised a four-wheeled machine with a body having two seats and the mechanical elements beneath and to the rear. A reservoir contained the supply of gas for fuel, a sprocket chain transmitted the engine's power to the wheels, a rod controlled a steering mechanism, and a brake was available for stopping the vehicle. However, Lenoir soon perceived the desirability of substituting liquid petroleum as fuel, and in 1862 or 1863 designed a suitable engine. Apparently, he built a lighter model than his first gas engine, running it much faster—400 r.p.m. He utilized the principline of carburetion, perhaps employing a developmental model of the large but effective carburetor patented by Festugière in 1865. His carriage with its new power plant made a run from his Paris carriage factory to Joinville-le-Point and return, a total distance of twenty-four kilometers, in three hours, thus showing a speed of more than five miles per hour even including stops.[8] But the improved engine was doubtless still heavy and the carriage mechanism undependable, for there is no evidence that Lenoir at this time continued his automotive activities.[9]

Lenoir's gas engine was of the non-compression type, and if his petroleum engine used the compression principle, which its rapidity of motion suggests, it was nevertheless not a commercial success. The Otto & Langen, as we have seen, became the dominant gas model in Europe, while the Brayton was most highly successful in America.

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* In a letter printed in [illegible]

[illegible] for any other purpose," i.e., for carrying goods or passengers.

As neither was satisfactory, Otto and Langen, working at Cologne with their chief engineer, Gottlieb Daimler, were devising a new type as the 1870's advanced. Of course, they had heard of the Brayton, and on January 20, 1876, Langen ordered two of these engines. However, by the time these had arrived at the Deutz factory, the new Otto was already being pushed to completion, and all the Germans got from their American purchases was the knowledge that when their new machine was ready, it would have nothing to fear from a transatlantic rival.

Their improved engine was in part the result of some experiments which Otto had begun in the 1860's. He had stumbled, in or about 1861, upon the idea of a four-cycle motor, but had abandoned the project to work on what became the two-cycle, free-piston Otto & Langen.[10] Meanwhile, in 1862 a French engineer, Alphonse Beau de Rochas, had discussed the four-cycle theory with illuminating clarity. He proposed a sequence of operations that must have seemed fantastic to engineers already devoted to the double-acting principle which they had borrowed from the steam engine.

In theory, this principle insured a full supply of power. What more logical than to drive the piston in one direction with an explosion, and send it in the opposite direction with a second, acting on the piston's other side? But actually this system did not permit the introduction of an adequate amount of gas, or a complete exhaustion of burned elements, for the rapidity of the explosions and movements gave insufficient time.

Beau de Rochas perceived that by using an ample charge of gas, a much more powerful impulse could be given the piston by a single explosion, and that this would carry over for two revolutions of the crankshaft. It would also perform fully the needed work that the two-cycle motor (which either did not compress the charge, or wastefully compressed it outside the cylinder) did not perform. He proposed the following method of operation:

1. The piston on its first stroke (half a revolution of the crankshaft) would draw in an explosive charge throughout the entire stroke, thus supplying ample fuel.
2. The second stroke would compress this charge.
3. Ignition would take place at "deadpoint," or the end of the second stroke, and the explosion and expansion would drive the piston for the third.

4. The final stroke would completely exhaust the burnt gases, and the cylinder would be cleared for a new intake of fuel.

Although this analysis, describing the four-cycle mode of operation, with four strokes to complete the basic unit of engine operation, anticipated the action of the standard internal combustion engines for generations to come, and was seen to be a significant proposal, neither Beau de Rochas nor any other engineer attempted to put it into practice.[11]

Otto was then deep in the development of his atmospheric, free-piston motor, and doubtless this and the Brayton engine seemed to most inventors to open the most practicable paths of development. But in or near the 1870's, Otto finally returned to the four-cycle idea, and began to build an engine based on that principle. He received aid from Daimler and Maybach, the former being rewarded for his suggestions and work with a block of shares in the Deutz company. On August 4, 1877, Otto obtained a patent for the new motor,[12] which had none of the objectionable features of the Otto & Langen. Compact in appearance and quiet in operation, it merited its popular designation, "the silent Otto." A single-cylindered, horizontal type, with a slide-valve flame ignition, it employed a large flywheel to regularize the operation, since there was but one working stroke in four, or in every two revolutions of the crankshaft. All the requisite work was done, and done effectively, within the cylinder.

When the "silent Otto" was exhibited at the Paris Exposition of 1878, its effect upon users of internal combustion engines was comparable with the sudden snapping on of an electric globe in a room men had been trying to light with smoky candles. "This engine rapidly supplanted all its competitors and became the basis of all modern gas engines irrespective of the original form of fuel," one authority declares.[13] It was quickly licensed for manufacture and sale in England, France, and other countries, including the United States, where it was being manufactured by 1882.[14] The Brayton faded from the scene, and while efforts to produce a two-cycle motor continued, after this time the four-cycle became increasingly popular, particularly where smaller engines were desired.[15] The basic engine for a motor vehicle had been created in the new model. But Otto and Langen showed no interest in applying it to such a use; their energies were fully occupied with

the manufacture and sale of the "silent Otto" as a stationary unit.

Meanwhile two other men, one in Europe and one in America, had done significant work in the field of the gasoline-propelled carriage.

Siegfried Marcus, the European, was born near Hamburg in 1829. As a young man he worked for Siemens & Halske in Berlin, and devised improvements for the first telegraph between Berlin and Magdeburg, completed under the direction of Werner von Siemens. In 1852 he went to Vienna, working as a mechanic at the Physical Institute of the Imperial Joseph Medical Academy, and later in the chemical laboratory of Karl Ludwig, professor of physiology, thus gathering valuable training in physics and chemistry to supplement his electrical and mechanical experience. In 1860 he opened a small workshop; but its equipment was limited, and he also used other shops in perfecting various inventions. These included a thermopile, a telegraph relay, electric, gas, and alcohol lamps, a new kind of galvanic cell, a loudspeaker microphone, and a cigarette lighter.[14]

Marcus had experimented before 1860 with liquid fuel atomized to produce a gas which he called "carbureted air," and used as a substitute for illuminating gas in lighting and heating. About 1860, he took a new step, employing his mixture to operate an atmospheric engine which had a general resemblance to the Otto & Langen, but which antedated that power unit. Indeed, Marcus seems not only to have had an engine by 1864, but to have installed it on a crude four-wheeled wagon or hand-truck. He experimented with this at night (for fear that daylight maneuvers would be prohibited) and one Austrian later described taking a 200-meter ride in it at dusk, near the Schmelzer cemetery.* Because of the explosive sound of the motor the police soon forbade even such experiments.

After temporarily abandoning his automotive researches, Marcus apparently was so impressed by Beau de Rochas's theory of the four-cycle engine that in the early 1870's he developed a model of this type and constructed a carriage for it. The motor was a one-cylinder, horizontal unit, antedating the silent Otto, and using a timed electric spark for ignition, generated by the engine itself. (Marcus's earlier model had also operated by electric ignition.) The engine employed a slide-valve for intake and a disc valve for exhaust; it had an efficient car-

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* Albert H. Curjel. His account is quoted by Kurzel-Runtscheiner (p. 19) from the *Zeitschrift Des Oesterreichischen Ingenieur-und-Architekten Vereines,* where it appeared in an article "Oesterreichs Anteil an der Entwicklung des Automobils," in 1924.

buretor, and the cylinders were water-cooled. The engine, which could be started from the driver's seat, was regulated by a small hand-wheel and a throttle which governed the supply of fuel. A worm-wheel steering mechanism was used. The transmission was by rope and pulley, and the car was stopped by a friction brake. Marcus did not employ a gear-shift, and the forward wheels used a pivot mounting adapted from the horse-drawn carriage. All the wheels were of carriage type with heavy spokes and iron rims.

It will be seen that the carriage embodied a number of strikingly modern features, and its general appearance while crude compares favorably with that of later experimental vehicles. "The second Marcus wagon of 1875," writes an Austrian expert, "is far superior in general construction and detail to the first productions of Daimler and Benz ten years later."[17] Such an assertion is arguable, but Marcus's car was certainly comparable with those later models. Had he had not refused, in spite of available financing, to develop his carriage further because he saw no prospect of commercial success, had he not delayed taking out patents until May 30, 1882, and July 24, 1883, (a characteristic procedure with him, for he always sought to work out the details of an invention fully before making such applications), and had various records not disappeared after his death in 1898,[18] his machine might well have ushered the automobile into general use, or at least have been accepted as the first really effective gasoline-propelled carriage. Unfortunately it stands instead merely as an interesting experimental model, the exact capacities of which were never fully proven.

Meanwhile in Rochester, New York, about the time the Deutz factory at Cologne was producing the new Otto, a young patent attorney was building an engine, and passionately studying the problem of applying it to a road vehicle. George B. Selden, born in 1846, was a descendant of a Thomas Selden who had come from Kent, England, to Hartford in 1636. His family was distinguished, his father having been a judge and a lieutenant-governor of New York State. By instinct young Selden was undoubtedly an engineer, and with proper training might have taken a higher place in the technical world than he was eventually to assume. But his preparatory school training and his university work—first at the University of Rochester and then at Yale—had been "classical" in character. It had been interrupted by the war, in which he served in the Sixth New York Cavalry and the Hospital

Corps, and then by a sudden illness of his father which sent him to Europe, where the latter had been traveling. On his return he did not resume the regular course at Yale, but registered at the Sheffield Scientific School; in a few months, however, he returned to Rochester at his father's request, studied law with him and an uncle, and in 1871 was admitted to the bar.

Selden's talents had been diverted from their proper channel; but even so, he was too much centered on mechanics to follow in his father's steps. He married and began to practise, but soon showed an interest in patent law and devoted an increasing amount of his time to inventions. While preparing for his bar examinations he had devised a hard rubber tire for bicycles, which he followed with a typewriter, a tractor "dog" to prevent wheels from slipping, a machine for making barrel hoops, and a device for producing hoops that were half-round. More important, from the early 1870's he became intensely interested in the idea of developing a "horseless carriage."

Like a number of others, Selden at first considered using steam as a motive power, but about 1873 abandoned any such idea and turned his attention to internal combustion engines. After building one or more unsuccessful models, he apparently concluded that an adaptation of the Brayton engine offered the best chance of success, and in 1876 planned a light-weight three-cylinder engine of this general type. He went further: he designed *on paper* a road vehicle for his motor, believing that it would be possible to procure an overall patent on such a machine. The patent application which he finally worked out described and illustrated by diagram the carriage body, the engine, and the flame ignition which he proposed to use, the position of the engine, a method of obtaining different speeds and letting the motor run free, a steering apparatus, and a brake for stopping the vehicle. While Selden asked for a patent on the comprehensive plan, he also tried to cover by basic descriptions all the important separate elements. His purpose was so to use his knowledge of law that his patent would cover any practicable vehicle that might be devised by any other inventor while he was perfecting his own for use.[19]

Since by this time it was 1878, it may be asked why Selden did not model his motor on the Otto rather than on the Brayton. The answer is complex. He had invested time and money in his Brayton adaptation. In 1876, moreover, when he built his own engine, American

technical opinion preferred the Brayton to the Otto & Langen, which was then the only Otto motor widely known. If he read the *Scientific American,* Selden could not have doubted this fact; and for a car in particular, the Brayton was at that time much more promising than the noisy, ill-shaped German product. Even if Selden noted in 1878 that a new Otto had appeared, he might still have preferred to gamble on the model he himself had produced and tested. The triumph of the German engine was not fully recognized until the early 1880's.

He submitted his patent application on May 8, 1879.[20] However, he did not permit the patent to be issued, but kept it alive by filing additions or changes which involved a series of postponements. He was to continue doing this for more than sixteen years. Many students have assumed that this shrewdly calculated process, then quite permissible under the federal law, marked Selden as a mere legal juggler, who shrewdly watched the progress of automotive efforts and adjusted a verbal trap to cover and render subject to him any creative efforts to produce a self-propelled vehicle that might be made in America. This does him a considerable injustice. "For years," says Carl Mitman in the *Dictionary of American Biography,* "he tried without success to secure financial help so that he could build a machine." Another account pictures him, "handicapped by impatience and irascibility," as naturally ineffective in finding capital and backers.

He had actually brought a Rochester business man to the point of putting up $5000, when he impulsively remarked: "Jim, you and I will live to see more carriages on Main Street run by motor than are now drawn by horses." His business friend was shocked. "George," he said, "you are crazy, and I won't have anything to do with your scheme." Twenty-five years later the same man met Selden on a Rochester street, extended his hand, and said, "George, you were right years ago when you said there would be more automobiles in Main Street than horses."

Selden ignored the outstretched hand, and blazed: "Yes, and I wasn't so damned crazy as you and the other fools said I was," and walked away.[21]

Thus a tragic aspect pertains to this lonely, moody lawyer with a patentable conception which no one would buy. We do not know whether Selden could have constructed an operable car, but apparently he made some effort to carry his ideas into practice, and only when convinced that he was far ahead of the times did he adopt the plan he

finally followed. But whatever the ethics of his procedure, perhaps no more audacious attempt to control mechanical developments in a new field has ever been made in America or elsewhere.

3.

Of these exciting developments little was known to young Americans like Haynes, Duryea, and Henry Ford in America except the character of the "silent Otto," which of course was now being used in the United States. None of them had heard of Selden's activities, or, probably, of experiments made by Brayton, who in the middle 1870's installed his motors in boats and streetcars and fitted one of special design into an omnibus. This vehicle was maneuvered back and forth in a testing shed in Pittsburgh and even driven out on the street. It was not really successful, however, and any attempt to operate it was prevented by the attitude of the city authorities.[22]

Nevertheless, the new Otto was known to these young Americans. Actually it was to prove the most significant of all the accomplishments just described, and might have started American automotive experiments in the mid-eighties. Shanck was undoubtedly familiar with it, and Henry Ford was to see a model in 1885. However, the cumbersome stationary engine could not have seemed very promising as a power plant for a carriage. Duryea recalled that when he first saw Shanck's model it looked "as big as a kitchen stove,"[23] and it was probably only on reflection that he became convinced that he could design a lighter, less cumbersome engine. Ford and Olds were still thinking of steam as the most suitable means of propulsion.

One inventor in Europe, however, had perceived clearly the possibilities of the four-cycle gasoline engine. Gottlieb Daimler had nursed a vision of a self-propelled car from the 1860's, and had worked on an engine for it. But while he was serving at the Deutz factory, contributing to the success of both its motors, he developed nothing of his own. An unhappy friction always existed between Daimler and Otto. Doubtless Otto was conscious of the superior scientific background and manufacturing experience of his chief engineer, while Daimler seems to have specially resented the fact that Otto, despite his relative technical illiteracy, could take a place among the foremost pioneers in motor design. In 1882 the clashes between the two became serious, and Daimler was asked to leave. He was offered the opportunity, however, to

set up a branch factory for the Otto engines in Russia, where he had introduced them.

Daimler rejected this suggestion, removed to Cannstatt-Stuttgart, and set up a small factory on his own property there. He knew the Otto engine thoroughly, and perceived that with vital changes it could be adapted to a vehicle. He determined to build a much lighter model, which would compensate for lack of size by a drastic increase in the number of revolutions per minute. He realized that he faced two specially difficult problems: a satisfactory ignition and the use of petrol as fuel instead of gas.[24]

By the summer of 1883 Daimler had succeeded in completing his design, and the finished motor was ready August 15, 1883. Although it had met his hopes as to ignition and fuel, perhaps its chief importance lay in its speed of operation. While the early gas engines had run at from 60 to 100 r.p.m., and even the four-cycle Otto operated at 180–200 r.p.m., Daimler's achieved 900. It weighed only a little more than 80 pounds per horse power, then an encouraging ratio. Daimler had made immense progress in providing a suitable fuel mixture, for by studying how to produce gas from petrol, he had fixed upon a proportion of ninety-one parts of gasoline to nine of air as the most efficient blend. His carburetor produced such a fuel and discharged the proper quantity into the engine cylinder for a four-cycle operation. He devised an ignition which depended on a heated platinum tube and the results of compressing the mixture—that is, ignition was precipitated as compression was completed. The motor was at first air-cooled, and later water-cooled; it used oil for lubrication.

Daimler had no doubt as to the revolutionary character of his design. "I have created the basis for an entirely new industry!" he declared. He compared his motor to the improved Otto by saying it was to that machine as a quick-firing modern rifle was to a blunderbuss.[25] It was indeed true that he had developed the first motor notably fitted to serve as an effective power plant for a self-propelled vehicle. It promised lightness, compactness, and high efficiency. Meanwhile a fellow countryman, Karl Benz, had developed a motor independently. The accomplishments of these two men from 1883 onward will be recounted in the ensuing chapter.

Among the group of young Americans teased by dreams of better motors and self-propelled carriages, Henry Ford was aware of immedi-

Map showing places related to Henry Ford's activities, 1883–1891.

ate possibilities for automotive progress. He was still observing current developments and hoping for opportunities that would shape his own personal fortunes as an inventor. But at this time an event occurred which would deflect him for a time from his intense absorption with machines.

4.

One winter evening early in 1885, at a party in Greenfield township, he sat out two dances with a young woman whom he had recently met, and showed her a watch he had made. A standard railroad time had recently been established, but people near Dearborn used "sun time," which differed from it. Henry had designed his watch with two dials that kept both. On returning home that night, Clara Jane Bryant told her parents about this quiet, pleasant, keen-minded young man. "He's a thinking, sensible person—serious-minded," she announced. "He's worked out something different."[26]

Clara was eighteen; she would be nineteen that April. Her father, Melvin S. Bryant, worked a forty-acre farm on Monnier Road (now Schaeffer) not far from Greenfield post office in the township of that name. He and his wife Martha had ten children, three daughters and seven sons. As the oldest, Clara had known her full share of responsibility, and although she was an attractive, lively girl, she had already developed a strong sense of the practical.[27]

Henry had met her some weeks before the dance, perhaps at a New Year's eve party, and became interested in her "right from the beginning."[28] His sister Margaret had in her own words been a "life-long friend" of Clara, but later said that her brother had never become acquainted with the latter until two years after he returned from Detroit. He was quite busy and away much of the time, and until his second year at home he had not gone to dances. It was long a legend that Margaret was the hostess at the party which brought Henry and Clara together, and that it was held in the Ford home. In 1951 Mrs. Ruddiman denied this, insisting that the two met at the Martindale House. Henry, she explained, had just taken up dancing. "There were no teachers in those days. He just learned at the parties."*

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* Mrs. Ruddiman's [illegible]

[illegible] as the ensuing text will indicate.

The Martindale House stood on Grand River Road, some two miles southeast of the Bryant home and about six northeast of William Ford's. Apparently it was a spacious, well-appointed hostelry. We can picture Henry standing in the doorway of the ball room, and under the soft light seeing Clara, a dark, graceful girl with chestnut-colored hair, who immediately attracted him.[29]

For her, he was just another young man, and Clara Bryant did not lack young men. "She had quite a few beaux," Margaret Ford Ruddiman said years later. "She was a popular girl, very sociable."[30] But once the young lady from Greenfield became aware of Henry as someone more original and mature than her other suitors, she began to take an interest in him.

Clara was not only the oldest of the ten Bryant children, but also the best-balanced. Her two sisters, Kate and Eva, grew up to be attractive young women, but both were less stable than Clara, Eva in particular showing considerable wilfulness and asperity.[31] Of the boys, Milton became the most successful, winning election to the state legislature and making a modest success in business, first for himself and later as a Ford dealer. Clara had the sociability and charm which characterized the family, but with it plenty of common sense and the instinct for economy already noted.

Henry Ford soon acquired a sleigh for taking Clara about. Legend pictured it as a very special affair which he himself built and fitted with "cushioned shock-absorbers and steel-cut tires," and painted red.[32] Henry's sister has deflated this account. "My brother did not make a cutter for Clara. He bought it for her. It was a typical cutter. It was green, and not red as they say. There were others like it, the same style."[33]

Mrs. Ruddiman has given us a revealing description of a musician who officiated at the dances the two attended. "At those parties they had a man who played the dulcimer—George Race. He was a cripple. This instrument would be on a table, and he played it with little mallets, and called off the dances as he played. He really played beautiful music."[34] The large ballroom lighted by hanging lamps and candles,[35] the young people moving through their quadrilles, reels, schottisches, and polkas, the tinkling dulcimer, the called-out commands to the dancers—we can imagine the charm of the hour. It had a magic that Henry Ford always remembered with a sentimental fondness, con-

trasting it contemptuously in the 1920's with a more modern activity in "badly ventilated restaurants, where, with only a few square feet of floor amid the tables, there could be no real dancing."[36]

5.

Everything that Henry Ford learned about Clara Bryant was calculated to intensify her original attraction for him. While she was a regular church-goer, having been confirmed in the Episcopal Church at fifteen,[37] she took her religion with a quiet naturalness, and never seems to have tried to draw Henry into an active church role, as had his cousin Mary Catherine Noble. He doubtless saw that she was experienced in helping to manage a large household and had sensible ideas about economy. He found that she was a good listener when he talked about machinery and his plans for developing machines of his own. Finally, about this time she met with more than credit a test to which she was accidentally subjected.

It was a casual but for Henry an important test. William Ford wanted to clear some additional land for crops. Most of this seems to have been acreage from which the timber had been cut, but on which the stumps of the trees remained. To make the soil fit for cultivation the stumps would have to be removed, a project that would require a number of men and teams. Henry proposed to do it with a steam engine, and William, doubtless glad to make any arrangement that promised to increase his son's interest in farming, agreed. Henry borrowed a Westinghouse engine from John Gleason and happily set to work. It was not long before he persuaded Margaret and Clara to visit the scene of operations.

"He was proud to demonstrate how much easier and better such a machine could do the work [than men and horses]," his sister recalled in 1951. "Whenever Clara and I could get away he had us ride on the engine with him and we went into the fields where we could watch him operate the machine. He was so enthused at that time with this way of taking so much hard work out of farming that he could talk of little else. Clara and I were 'good listeners,' but, I must confess, all this talk meant little to us at the time. I am sure, however, that Clara's willingness to ride on this engine and to go into the fields and watch Henry at his work further convinced him that she was the proper girl for his wife."[38]

Clara for her part became convinced that he would accomplish something notable. Did he not have a magic touch with machines, from the smallest ticking watch to the most powerful engine? Was he not already an "expert," one who was sent by Westinghouse to help set up one of their products at Milan, Michigan, and called by the Eagle Iron Works in Detroit to repair the mysterious gas-driven Otto that nobody else understood? Clara had no reservations. She became "the Believer," as her husband and his family later called her.[39] By February, 1886, the two had reached a firm if not a formal understanding. A single letter from Henry to Clara, fortunately preserved and dated on St. Valentine's Day, gives us a full glimpse of the young man's heart:

> Springwells Feb 14th 86
>
> Dear Clara
>
> I again take the pleasure of writing you a few lines. It seems like a year since i seen you. It don't seem mutch like cutter rideing to night does it but i guess we will have some more sleighing. there is a great many Sick in this neighborhood i have called on five sick persons this afternoon three in one house. it seems to bad colds our folks are about all over it John is going back to school tomorrow i hope you and your folks are all well. Clara Dear you did not expect me Friday night and i think as the weather is so bad you will not expect me tonight, but if the weather and roads are good you look for me Friday or Saterday night for the opera or Sunday night or Monday night at the party and if your Brother has got some one else let me know when you write but i guess i will see you before then. Clara Dear, you can not imagine what pleasure it gives me to think that i have at last found one so loveing kind and true as you are and i hope we will always have good success. Well i shall have to Close wishing you all the Joys of the year and a kind Good Night.
>
> May Flowerетts of love around you bee twined
> And the Sunshine
> of peace Shed its joy's o'er your Minde
> From one that Dearly loves you
> H.[40]

It is clear that the young machinist, however diligently he may have filled the few previous years with planning for future work, and however busy he may have been at present labor, had nevertheless felt a hunger for understanding and affection. While he was doubtless con-

tinuing to ponder upon the possibilities that he might develop in the machine world, and to carry forward some experimenting in connection with them, Clara and his marriage were now undoubtedly the important things in his mind.

At about this time William Ford made a proposal which fitted in with the plans of the young people. He called Henry's attention to the eighty acre tract of land which he owned about three-quarters of a mile west of his main farm, on what is now Ford Road. It was called the Moir place, from the owner who had sold it to William in 1865, and it contained a large stand of timber. "My father offered me forty acres of timber land, provided I gave up being a machinist," Henry Ford said in 1923. His sisters and others thought that the entire eighty was offered.[41] The young man did not accept outright. "I agreed in a provisional way, for cutting the timber gave me a chance to get married."[42] A rude little house already stood on the tract and could be used as a temporary residence. A steam engine could be rented or purchased, a simple "mill" constructed, and the place made to pay from the start. The tract would provide lumber for the building of a better home. Apparently Henry took up the offer at some time between late 1886 and the middle of 1887. A tax receipt for 1886 appears among William's papers, but in the one following Henry seems to have paid the taxes, and in common with an "F. Frank" he also paid a $1.49 tax on a saw mill valued at $250.[43] Thus by the time taxes were due for 1887 he was prepared to operate the mill, and probably did so for many months preceding his marriage.

With land, a mill, and an income at his disposal, Henry Ford would have seen no reason for delaying the wedding. Clara shared his view, and the engagement of the two was now announced. Mrs. Ruddiman stated that the news was broken in the "early spring" of 1888, and a letter to Clara on March 17 from her cousin M. F. Stellwagon in northern Michigan shows that she had written to him about the marriage before that date.[44]

Doubtless in making the arrangement about the Moir place with his father, Henry Ford had in mind not only building a mill but erecting a small machine shop in which he could "tinker" with engines and other machine possibilities. He later put it that he had agreed to William's proposal "more because I wanted to experiment than because I wanted to farm."[45]

The wedding was to be held at the Bryant home on Clara's birthday, April 11, 1888. An invitation survives, the card bearing a silver spray of blossoms and leaves at the top.[46]

The Bryants lived in a brick house which at this time was only several years old.[47] It was apparently a large and attractive one; years later, when the building had to be torn down to permit the widening of the road by which it stood, Clara and Henry Ford used the bricks for a small chapel, called the Mary-Martha in honor of their respective mothers. The Bryants had been old residents of Greenfield. John Bryant, Clara's grandfather, a native of Canada (1809), had evidently come to the township in the early 1830's. His wife, Jane Bogert, was born in Cherry Valley, New York, in 1813. Their son Melvin, Clara's father, had been born in Greenfield in 1836. Both grandparents had been present at Clara's christening.[48]

The Bryants and the Fords had many relatives and friends, and the invitations went to a large number of people. "There was a houseful," said Margaret Ford Ruddiman of the guests in describing the occasion.[49] In 1928 a cousin of Clara Bryant Ford, then a Mrs. Gerecke but formerly Bessie Wynn, stated that "Henry and Clara stood in the archway of one of those old-fashioned deep bay windows." The Rev. Samuel W. Frisbie, of St. James's Episcopal Church, Detroit, officiated —the same clergyman who had conducted Clara's confirmation.[50] Martha Bryant and William Ford signed the marriage certificate. Clara, as Margaret Ford Ruddiman remembered, (she had helped the bride-to-be dress) wore a gown she had made herself, Henry, a blue suit. After the ceremony a supper was served, two tables being put across the end of the dining room and the older Bryant boys doing the serving.[51]

Meanwhile Margaret Ford and her brothers had prepared the house on the Moir place for the bride and groom. "It had to be decorated a little and cleaned up generally, and we all did it." After the wedding party, "they went to the little house for their honeymoon."[52] Thus Henry's and Clara's married life began with a frugal simplicity which was to mark it for the next sixteen years. It suited both of them. Henry wanted a quiet existence and time to spend in the workshop which he had probably already established on his "farm." Clara valued economy because it meant security. She was even then planning a better house, and knew that money would be needed for that. Both she and her

husband regarded marriage as a partnership which, while happy, meant work and responsibility.

William Ford at last saw his oldest son settled on the land, and, as he thought, bound soon to recognize the advantages of a farmer's life. But in his assumption that Henry had now come back to stay, he did not take due account of the dominant interests, restless imagination, and stubborn persistence of that young man.

6.

The land on which Henry and Clara Ford took up their residence was one of the few remaining solid tracts of uncut timber in the neighborhood. A considerable portion of it had been cleared near the road and the timber sold, for William had had tenants there for some years.[53] He himself had cut timber on this "farm," selling it for cordwood and perhaps to the Detroit shipyards and lumber mills. Henry Ford's statement in 1923 that his father had given him forty acres may mean that there was that amount of land covered with uncut timber, and that the rest was cleared land or stumps.

It should be noted that although many people, including Henry himself, have spoken of the land as having been "given," there was actually no legal transfer of the property from William to his son. The County records show that the father cleared a $1000 mortgage on the place in 1866, and that from that time forward it remained in his possession until 1903, when indeed the eighty acres were sold to Henry and Clara for $1, subject to certain conditions.[54]

Probably what happened in 1888 is that William said in effect to his son: "You can move onto the place and cut and sell the timber, and then make a farm of it. If you do that, the land will be yours."

At any rate, the newly-married couple occupied the little house and the land with the apparent belief that both were theirs for a long future. Henry built and equipped "a first class workshop," which he says was near the site of the new house that he and Clara soon began to build. This stood nearer the road (now Ford Road) and some seventy-five yards to the west of the old one.[55]

The timber seems to have been excellent, probably including some fine black oak, elm, maple, and ash.[56] Henry not only cut and sold his own timber, milling some of it and sawing the poorer part of the crop for cordwood, but also did sawing for relatives and neighbors.

Clyde Ford tells of his father taking a load of cedar fence posts to the Moir place in order to have them ripped in two, the halves still being of ample size for use.[57] Henry evidently delivered a considerable amount of timber and lumber to various factories, shipyards, and shops in Detroit. A receipt for $11.45 from the Detroit & Saline Plank Road Company dated October 27 ,1890, survives among his papers, and this single item would represent twenty-eight round trips at twenty cents toll each way. Several other receipts from a furniture company show that he supplied this factory with elm strips. Finally, a sheet marked April 6, 1890, reveals that James Ford, Sam Ford, George Ford, Jacob Esper, and others were indebted to Henry for a total of $403.77, apparently for lumber or sawing.[58]

Henry's sister Margaret states that Henry Ford "did some farming" on the Moir place—that is, planted and harvested crops aside from his work with timber.[59] She is emphatic that on the entire venture he made money. There seems no reason to doubt this, but how much he made is uncertain. When he left he still owed money on a small note, which was not paid in full until three years later.[60] On the other hand, in June, 1892, nine months after moving from the farm to Detroit, the Fords bought property there.[61]

Clara began drawing plans for her new house soon after the marriage. Henry cut, milled, and seasoned the timber for it, and the structure was completed to Clara's design by a carpenter. The square house, as it was called, was a simple story-and-a-half building thirty-one feet each way. In general it was American Colonial in style, and had a simple dignity. The interior was considerably altered and modernized in later years, but the outside appearance remained the same. The house was still standing in 1952.

Three weeks after the young couple had established themselves Henry received a letter from his boyhood friend Edsel Ruddiman. It was dated April 30, 1888, and Edsel had just heard of the marriage. "Henry, I give you my hearty congratulations and well wishes," he wrote, "and I sincerely hope that your lives thus united may be one of perfect peace and complete happiness in each other's love. . . . It makes me smile when I think how you used to tease me about the girls and here you are married and I am still single. . . . *God speed you both.*"[62]

It was a year from this time before the square house was ready for occupancy.[63] Clara doubtless left the rude dwelling that had been

their home all this time with a sense of relief. In an attractive, roomy, well-made home of her own she could feel that married life in its more comfortable and "decent" aspects had really begun. Henry's shop was attached to the new dwelling, so that he could walk into it from the house. Apparently no debt had been incurred; the farm had supplied the lumber and the sawmill had paid for the cost of building; the furniture seems to have been procured in trade for lumber.[64] Clara had some family pieces, particularly an arm-chair that had come from her mother's home in Warwick, England.[65] At some time while on the Moir place they acquired an organ.

7.

While he was successfully operating his sawmill, Henry was also busy in his shop. Possibly he repaired some implements or did other mechanical work for the farmers in the area: "He was known at this time to be a lover of machinery and a genius at using it," observed Clyde Ford when he recalled what he had heard of Henry Ford in the late 1880's.[66] Ford himself testified in 1904 that he used the shop for "all kinds of repair and experimental work."[67] However, his instinct at that time was unquestionably to picture himself as having had a long and varied experience with mechanical matters, and the shop was probably bigger in the testimony than it was on the farm.

According to various later statements his experimental work at this time—as apart from paid shop work—was both continuous and significant. He asserted, for example, that in the late 1880's he built an engine modelled on the Otto "just to see if I understood the principles." He described this unit as having a one-inch bore and a three-inch stroke. It worked "well enough," but he later gave it away. He also built (in 1890) a double-cylinder engine which he planned to put on a bicycle, "with a direct connection to the crankshaft allowing for the rear wheel of the bicycle to act as the balance wheel." He never tried out the plan, for he perceived that the engine, gasoline tank, and controls would be altogether too heavy for the slight vehicle.[68]

In these years, according to his statements, he also experimented with steam engines. He wanted to build one, he declared, which would pull a wagon or plow ("takes the work out of the farm") and actually completed a machine which ran about forty feet and stopped. This was supposed to have been a forerunner of the tractor; there was only one

cylinder, three by three and three-quarter inches. These details are furnished by only one biographer, but he had many talks with Ford.[69] The latter merely says: "I built a steam engine that ran," but that he had trouble devising a satisfactory boiler and "definitely abandoned the whole idea of running a road vehicle by steam."[70] He testified in 1904, in the Selden Patent Case, that he built various experimental engines. "They all ran." But, he stated, he destroyed them "because they were experimental engines and simply made out of tubing."[71]

In later years neither Margaret Ford Ruddiman nor Clara Bryant Ford remembered any of these experiments—that is, they did not remember any vehicles or engines. Mrs. Ford was sure that none was constructed during the period on the Moir farm. However, Mrs. Ruddiman recalled her brother's conviction that horses were not economical. "As far back as I can recall, he was determined to do somethting about it." She says further that shortly after his marriage he began to talk about a "horseless carriage," and that Clara was astounded at the idea.[72]

There are several possibilities. Henry Ford was undoubtedly interested in a vehicle propelled by its own power plant, and must have thought about the problems involved in developing such a machine, and years afterward may have persuaded himself that he had done things which he did not do. As already indicated, in the 1900's both his pride and his commercial interests might well have strengthened a tendency to invent. A second possibility is that he actually did a considerable amount of "tinkering." It would not be difficult to build crude models that would test certain parts of the complete operation. This seems the preferable explanation, for Ford was always a "cut and try" man rather than a designer in the theoretical sense. Two things seem certain: in this period he was excited by the idea of a self-propelled vehicle, and he built nothing that was successful enough or exhibited with sufficient emphasis to be remembered by anyone but him.

The Fords lived on quietly in the square house, visiting relatives and friends and leading a life much like that which Clara had always known. Henry farmed a small amount of cleared land, but was chiefly busy at the sawmill or in his shop. Occasionally he was called to Detroit to do a repair job. The family income was enough for Clara Ford to put something in the bank—from the first she seems to have had charge of the family funds.[73]

Meanwhile, the timber on the Moir place was being steadily cut and milled, and Henry could look forward to the time when it would be exhausted. If he remained on the eighty acres much longer he would have to remain as a farmer. That, of course, was what William Ford had assumed from the first he would do; Henry never seems to have looked beyond the cutting and sawing. There is no evidence that he made any preparations for a permanent stay—such as clearing and planting an increasing acreage and acquiring livestock and additional farm equipment. He himself never spoke later of any such activity, or, indeed, of cultivating the Moir acres at all.

Was he looking circumspectly for employment in Detroit? Apparently he had cocked his ear for a call, as will later appear. And early in 1891 he made at least one trip away from Dearborn, during which he was engaged in some kind of work, presumably mechanical.

Ford wrote two letters to Clara while he was on this journey, both apparently from Alpena, Michigan, a town on Lake Huron almost 250 miles due north of Detroit. The first is dated March 3, which was a Tuesday, and Ford had just completed his journey. At Lexington, on the southwestern shore of Huron, he had engaged passage by boat and a bed, had awakened in the morning in Saginaw Bay, probably at Bay City, and thence had continued to his destination. The trip took twenty-seven hours. He speaks of Alpena as having 14,000 people and "everybody friendly." The Fords were still on the farm at this time and the letter is addressed to Clara at Greenfield. "I wish you were here," he concludes. "I bet i will never go so far away from you again look for me any time after next Tuesday."[74]

The second letter is undated, except for "1891" and "Friday morning." The presumption, however, is that it is from the same place, and three days later than the first. Henry had evidently urged Clara to join him. "I looked for you last night and was so lonesome when you did not come," he writes. "I wish you had come for we would have staid over Sunday." He then mentions work. "i am very busisy they want me to stay but i will bee home for it don't seam as though I can stay another day without YOU if you get this in time Saterday come in to the depot where I left you at 4:30 but if you do not get it in time be at Greenfield at 7.OC if any thing happens I will [be] their later so do not worry

to my darling."

On the next page are five stanzas of verse headed "To Clara." The first of these runs:

> Drops of water and grains of sand
> Snowflakes and drops of dew
> The liquid ocean the crystal land
> The stars in ether blue
> Things of beauty—but 'neath the skies
> There's nothing so bright as my loved one's eyes.

Did Henry Ford write the verses? The heading and signature suggest that he composed the rhymes, and the level of sentiment, phrasing, and poetic skill is not so high as wholly to shut out such a possibility. In his notebooks are several couplets which seem to have been composed by him in later years. But in the same diaries he writes down many well-known lines of songs and poems without giving credit, any popular love poem would express sentiments much like this one, and the spelling and phrasing are better than those of Henry's letters.

Meanwhile, Henry Ford the machinist and potential inventor was restless, responsive to the steady development of a machine-conscious nation. It was a period of change and expansion, characteristic of the whole western world, but particularly vigorous and varied in the United States. With the massive growth of the American steel industry as a central stimulative force, and with railroading, oil production and refining, the new electric services (lighting, telephone, and power units), textile manufacturing, meatpacking and canning as outstanding activities, the country leapt forward in manufacturing to take first place among all nations.[75] Machine tools and labor-saving machines of innumerable types were already notable American products; domestic gas and gasoline engines now also began to appear—the Charter, the Otis, the Van Duzen, the Olds, and the Sintz—active competitors of the outstanding Otto, the advertisements for which boasted of a 25,000 sale.[76] Ranson Olds had already built a steam-propelled tricycle.[77]

Henry Ford was keenly aware of the general acceleration of mechanical progress, and of a number of the specific accomplishments which marked it. He had undoubtedly noted the development of American bicycle manufacturing. The bicycle, dating back to the eighteenth century hobby-horse, a crude arrangement of two wheels connected tandem-wise, with a rider perched on a saddle between and above them

and propelling himself by pushing his feet against the ground, had developed with the nineteenth century into a useful conveyance. Baron von Drais in 1818 had provided a moveable front wheel which permitted steering—the "draisienne," his improved model was called. Two Scots, Dalzell and MacMillan, had devised pedals by which the rider could activate the rear wheel; Lallemont and Michaux in France had done much the same thing for the draisienne and renamed it the velocipede. It came to the United States in the 1860's under this name. But the Europeans continued for a time to dominate its development, with Magee, a Parisian, constructing a model of steel and iron in 1869, and the solid rubber tire appearing the same year. The front wheel was enlarged and a brake provided; then in 1874 it became an enormous unit with a diminutive rear wheel trailing it. But in 1880 the Englishman Starley introduced his Rover, reducing the size of the front wheel and employing a chain and sprocket to motivate the rear one. This was the ancestor of the modern bicycle, and in time the giant-wheeled "ordinary" faded, although it was still dominant in the late 1880's. By this time Albert A. Pope had led the way to an American production imposing in quantity and fine in quality, and others of his countrymen like Thomas B. Jeffery, inventor of the clincher rim, were turning out the machines that Henry Ford saw in use, with their fine modern sprockets and gears, tubular steel frames, modern wheel-units with metal hubs and spokes, and, in a year or two, the pneumatic tires which Dunlop perfected in England.[18]

More important to him, he began to hear or read of steam and gasoline-driven vehicles—a few in America, more in Europe. Such intelligence was doubtless fragmentary and perhaps vague, but it must have reached him.

The sense of growing industry, of actual or impending inventions, disturbed him. Never sure that he wanted a farm on any conditions, drawn to the machines each time he was called for a repair job, he seems to have searched for some kind of employment in Detroit. One night in August or early September of 1891, he brought up the question of moving there.

He had returned from repairing an Otto engine at a soda-bottling plant in the town.[19] He had told Clara something about the machine, and announced his belief that it could be adapted for use in a road vehicle. Indeed, he stated, he had worked out the means of employing

it as the power-plant for a "horseless carriage," which he proposed to build as soon as possible. Clara as an previous occasions expressed her surprise at the idea of such a self-propelled carriage, and wondered how it could be contrived. This time her husband replied: "Get me a piece of paper and I'll show you."

Clara found a sheet of music on the organ, the back of which was blank. Henry sketched out his proposed invention, explaining as he sketched. To judge from other drawings made by him, there was probably more explanation than sketch. But to Clara both the design and the commentary seemed clear. She was convinced. "She had complete confidence that he could do it," said Mrs. Ruddiman in describing the scene as Henry and Clara told her about it.

But her husband had not finished. He proceeded to explain that in order to develop his ideas successfully he would have to know more about electricity, and that he wanted to work in a plant where he could get the necessary experience. He had made inquiries at the Edison Illuminating Company in Detroit and could find employment there as an engineer.

Clara was aghast. She had her house, they could become the owners of eighty acres of land, she was near her family and among old friends. A move to Detroit would disrupt the life they were living, tossing them into an existence she had never known, where Henry would have to begin again and the financial outlook was utterly obscure. The prospect violated her conservative instinct. She confessed years later to Margaret Ford Ruddiman that it nearly broke her heart to think of leaving the farm and going to the city. But such was her faith in her husband that she never questioned for a moment the importance of the project he had outlined, his ability to carry it out, or his need for the position in Detroit if he were to do so. She told him quietly that he had better take the job he had referred to, and they would prepare to leave the farm.

Actually Henry seems to have accepted the position before he talked with Clara about it. He was merely waiting for her to say "Yes." A former fellow employee at the Flower shop, John Wilde, who was now with Detroit Electrical, had procured him a post as night engineer.[80]

Clara and Henry made their preparations for moving to the city and found an apartment in a double house at 618 John R. Street. Ford said in the 1920's that his salary was $45 a month. "That was more

money than the farm was bringing me and I had decided to get away from farm life anyway. The timber had all been cut."[81] If this statement is accurate, he had been looking around for a position that suited him and had never intended to operate the Moir place as a farmer.

On September 25, 1891, he and Clara moved.[82] *For Henry Ford it* was consciously a big change. For William, as he watched his son's furniture leave the square house, it was the end of the old dream that his son would become reconciled to the life of a farmer. The father, a fair-minded, equable man, had doubtless foreseen the event, and took it philosophically.

As for Henry, animated with the conviction that his future lay with the shops, he perhaps did not realize fully the decisive nature of the action he was now taking. For not only did it mark his final dedication to industry, but it also meant a dozen years of persistent struggle before he would sharpen his rather vague ideas, find a definite goal, and begin to emerge as a symbol of change that affected the entire world.

VII

THE EVE OF REVOLUTION

THE house on John R. Street in which Henry and Clara Ford made their first Detroit home stood less than two miles north of the City Hall, in an outer and newer section of the town. It was a block east of Woodward Avenue and several blocks from the substation of the Edison Illuminating Company where the new night engineer was to work a twelve-hour shift beginning at six in the evening.[1]

The Edison Company in 1891 was competing successfully with the Brush Electric Light Company and the Detroit Electric Light [illegible] Power Company. For some years the Brush Electric had furnished street lighting; then in 1890 the Detroit Electric had obtained the contract. However, Detroit's new mayor, Hazen S. Pingree, who had been elected on his promise to dredge out the morass of city politics, had declared that Detroit should operate its own plant for street illumination.[2] Eventually, in 1895, he made good his proposal.[3] With the political clashes attending this change the Edison was little concerned, for its service was solely to householders. Founded in 1866, it made such rapid headway against its competitors that by 1895 it was furnishing light to 1200 of 1650 residences that used electricity and maintaining 65,000 of the 96,000 lamps in Detroit.[4] When Ford began work in 1891 its position was already strong.

As for the sub-station at Willis Avenue and Woodward, it supplied the residential area in that vicinity. Its equipment by 1895 included a 300-horsepower Rice Dynamo, an Armington & Sims 150-horsepower generator, and a 100-horsepower Beck steam engine;[5] whatever its other machinery, this electrical apparatus offered Ford opportunities for extending his experience, the reason he gave Clara for wanting to move to Detroit. With the Beck engine he was already familiar. Doubt-

less his knowledge of steam power plants had been an important factor in his appointment.

2.

The Detroit into which Henry and Clara moved was a dynamically changing city, with the contrasts always found in an expanding industrial center. As a former resident and a mechanic who had frequently been called in for emergency work at various factories, Henry encountered no violent surprises in his first months of residence. It will be useful, however, to note the principal alterations of the preceding decade.

Growth had been rapid both in population and in official area. Detroit now counted 205,876 residents, an increase of 76.96 per cent for the decade. As the *Free Press* of August 14, 1891, proudly noted, only Chicago among the important American cities had registered a larger gain (118.58 per cent). Meanwhile, the territory occupied by Detroit had expanded from 16.09 to 28.14 square miles. Productive capacity had far more than doubled, the manufacturing investment rising from $30,000,000 in 1880 to $77,351,546 ten years later. Fourteenth in population among American cities, Detroit ranked seventeenth as an industrial center.[6]

Many new establishments in both business and manufacturing had appeared during those ten years. The Federal Census listed 1716 engaged in mechanical and manufacturing activities. Among the newcomers were the Eagle Iron Works (1881), manufacturers of engines, boilers, and other mechanical equipment, where Ford in 1885 had repaired the Otto motor; Ireland & Matthews (1889), makers now of spun brass goods and stamped sheet steel, later of automobile parts; the Buhl Stamping Company (1888); the Detroit Steel & Spring Works and a variety of firms manufacturing engines and foundry products. Three of these last were soon to be familiar to Ford. Charles A. Strelinger & Co. (1885) was a tool and machinery shop notable for the range and quality of its stock. The establishment of John Lauer (1880) was prominent in the fabrication of fine tools, light machinery, and metal parts for artificial limbs. Finally, Henry M. Leland had come to Detroit in 1890, becoming the dominant figure in Leland, Faulconer & Norton, which quickly acquired a national reputation in tools and machinery. Both the Lauer and Leland plants were able to do

fine precision work, the latter possessing as high a proficiency in this respect as could be found anywhere in the United States.[7]

As industry grew, the city swept into its mills a multitude of foreign workmen; the Germans the largest group, and the Canadians, Irish, English, and Poles ranking next in that order.[8]

Although to the casual glance the city had not altered greatly, a closer scrutiny revealed impressive changes. Detroit still retained the garden atmosphere that had pervaded much of it in 1880. Sturdy maples, elms, and horse chestnuts shadowed the streets and lawns of many fine residences, while in the public parks flourished oaks, walnuts, beeches, and sycamores. Along many streets the tops of the trees on either side nearly met, and on Woodward near Grand Circus Park they formed "a beautiful arborean arch."[9]

In summer the residential districts were given liveliness by carriages which rolled along the shaded thoroughfares to the light drum-beat of hoofs. Even the street cars were still drawn on their iron-faced wooden rails by plodding horses, for electric trolleys did not displace these conveyances for another year or two.[10] The old-fashioned vehicles harmonized with the tall trees, the squarish, mansard-roofed houses which sprouted bay windows and turrets amid their lawns, the flagstone sidewalks, and the cedar-block pavements. Only the bicycles struck a more modern note—the old tall-wheeled "ordinaries" trailing their diminutive second wheels, or the "safeties" with the two small wheels and diamond frame which were soon to become standard. From their pneumatic tires (now rapidly coming in) to their gleaming spokes, tempered-steel tubing, and cunningly-meshed gears, they spoke of a new machine era.

But other signs warned Detroiters that industry was pushing into their lawns and gardens. The electric street lights, the telephone poles, the eruption of modern office buildings and factories among stately residences, the extension of industry along the water front, the increasing throngs of laborers and office workers who filled the street cars mornings and evenings—these announced that Detroit was becoming a noisier, harder, and less attractive community.

Certain districts revealed a dramatic change. One was the area dominated by the new Union Station, projected in 1881 and now being pushed to completion. This large building, said an 1891 news report, had delivered "the last decisive blow" to the residential areas south and

west of City Hall. "The depot not only promised to make life unbearable with the clatter and smoke of hourly trains, but it actually swept away houses that had once been the flower of the west end." Indeed, all the blocks within a half mile of City Hall were being absorbed for manufacturing or mercantile purposes. Such properties were in steady demand as another news article said, "for improvement and occupancy by concerns and establishments requiring central locations."[11] These changes denoted temporary deterioration as well as general progress. "When a manufacturing business pokes its greasy nose among the fine houses," wrote a reporter in June, 1891, ". . . then good-bye to green lawns and quiet life." The owners of the houses hastily decamped, and along with the reputable factory often came boarding-house keepers and less desirable tenants to debase the old houses or erect shack-stores and cheap saloons, many with gaudy blue, red, and yellow fronts.[12]

The wretched condition of the streets of Detroit worsened the appearance of blighted areas, and lowered the tone of the entire city. George Truman Kercheval, a vigorous apostle of good streets, lashed out in savage attack which made the pages of the *Free Press* blaze. He told how in the very heart of town he had seen a wagon-load of bricks stuck in the muddy clay where the paving had broken up. Only after four more horses were brought was it pulled out of the slough. "A few weeks since," Kercheval stormed, "a couple of ladies out in calling array passed in a carriage on a fashionable street, when presently I heard a shriek; the mud was up to the hub of the wheels, the horse was streaked with it, the windows were blotched with it, and the carriage was more than half over in a ditch, because the driver had stopped near the sidewalk to let the ladies out, and two wheels of the vehicle had sunk down in the ditch, so that had the driver not jumped the whole thing would have gone over."[13] Mayor Pingree had denounced the condition of the streets in his first message to the City Council on January 14, 1890. Declaring that more than half the 130 miles of cedar-block paving were unfit for use, he called for resurfacing with stone or asphalt.[14]

Other aspects of the town, however, citizens might contemplate with some pride. If the river front was noisy and smoky, that was its logical fate. It showed dozens of fine plants like the new Ireland & Matthews works opposite the western end of Belle Isle, while the development of the shore toward the mouth of the Rouge under the Rouge Improve-

ment Company, pushed by James McMillan, was an impressive achievement. By 1892 some $8,000,000 was said to have been invested in manufacturing units there, and the river had been made navigable for deep-draft vessels for three miles inland.[15] Near the center of town Detroiters were proud of Federal Square, where the new post office was being erected near City Hall. Residences there were being purchased and torn down to make room for handsome business buildings. The heart of the city, about the Campus Martius and Grand Circus, remained an attractive section of wide, tree-lined streets, where office structures, public buildings, the opera house, theatres, some fine hotels, and a few handsome old residences made a brave display.

Since 1880 great waves of residential construction had surged out over open areas within the city and spilled across its limits at many points. To the west, settlement had reached Woodmere Cemetery, five miles from City Hall. "Where but a short time ago were reaches of bare commons," wrote a reporter in the summer of 1891, "are now many new houses, gradually growing thicker and more numerous." Extension of the street car lines provided transportation.[16] To the east the Germans were established from Mt. Elliott Cemetery to the water works at the city boundary. Polish families were settling to the northeast, while directly north from the Grand Circus, on either side of Woodward Avenue, pastures and market gardens were vanishing before new streets and hundreds of residences were being built for well-to-do-citizens, many of whom had been driven from the more central portion of the city.[17] "It is a great community that is growing up within a radius of four miles from our city hall," declared the *Evening News* of January 1, 1891, "and that will within ten years be spread out for a couple of miles beyond the present lines of the corporation."

As it grew, Detroit had not been neglectful of civic improvement. Belle Isle, the largest and most attractive of its parks, had been accessible by a bridge constructed in 1889 at a cost of $295,000. The island had been immensely improved. Marshy areas had been excavated to make lakes; a casino, tennis courts, baseball fields, a skating pavilion, and a boat landing had been constructed; lawns, a twelve-acre deer park, and numerous gardens were laid out. Detroiters drove, cycled, or walked to the island, where they fished, played ball, rowed, or paddled about on its lakes, or idled in the woods or along the shores, ad-

miring "the lotus, the dahlia, the calundian, the water poppy, the water hyacinth, the canna and the water lily."[18]

As both an adornment and an aid to transportation, a Grand Boulevard to girdle the city was proposed in 1876, and two years later the legislature authorized its construction. In 1883 its course was fixed, and with the aid of private gifts, the city began work. The thoroughfare, enclosing almost fifteen square miles of the central portion of the city, was well advanced by 1891. A reporter that year praised warmly the appearance of the completed portions. "There are two roadways, each thirty feet in width, with a grass plot between, and they wind around through a stretch of rolling land covered with trees and thick foliage. The winding, rolling road, running around handsome flower beds, presents the appearance of a beautifully kept park." All the land for the right of way had now been acquired, and the Commission in charge was preparing to move away a group of cottages which had been an impediment.[19]

Detroit was conscious of its defects, but still more conscious of its growth, its vigor, its mighty possibilities. It was gaining national prestige. On July 16, 17, and 18, 1891, the town was host to the League of American Wheelmen, and on August 3 to the Grand Army of the Republic for its Silver Encampment. To Henry Ford the bicycle parade should have been of particular interest. The riders travelled by night down Jefferson Avenue to the Belle Isle Bridge, bearing lanterns and making "a magnificent showing." The moving line of thousands of cyclists crossed the bridge as fireworks brightened the sky. Fifty thousand Detroiters lined the streets, and 20,000 more had assembled on the island.[20] The day of the bicycle had dawned; it was already a national emblem of sport and a focus of machine skills.[21] Ford, now or soon the owner of one, showed during the next few years that he perceived a relationship between the bicycle and the gas-driven vehicle he was then planning to construct.[22]

His instinct had been sound when he turned to Detroit, for in that industrially well-muscled city he would find a stimulating atmosphere for his work, and get definite aid in manifold ways. He could meet men who were moving toward the goal which he had set himself, and who would help him to reach it. Late in 1891 he stood on the threshold of adventures which would occupy a dozen difficult years.

That year was also the threshold of the age of the automotive vehicle,

destined so largely to reshape industry and social life in America. We must turn back to trace the events which had now brought that new era in transportation to the verge of fulfillment, and we must also note the character of the still relatively small automotive world. At this time in the opening nineties Ford was only one of dozens if not hundreds of adaptors and inventors who were dreaming of a motor car, and who in some instances would reach their goal before he did. All these men were influenced by what had occurred in the realm of motor vehicles since 1885.

3.

After completing his 900-r.p.m. motor in the fall of 1883, Gottlieb Daimler had at once begun to plan for its use in a vehicle—or rather in several, for he considered powering a bicycle, a four-wheeled-carriage, and a boat. About this time Karl Benz had reached a comparable stage in his own automotive work.

Born at Karlsruhe in 1844, ten years later than Daimler, Benz had received advanced technical training at the Polytechnic School in Karlsruhe and had absorbed an extensive practical experience, first as a workman and then as an engineer. He claimed to have worked out a design for a horseless carriage at the age of twenty. Three years later he was experimenting with a *draisienne* or velocipede, thinking that he might be able to build an engine for this machine. He soon abandoned that idea, realizing that the vehicle would be too light for any power plant that he could devise. However, he persisted with his experiments in the engine field; in the early 1870's he developed a two-cycle gas engine and then found backing to establish the Mannheim Gas Engine Company. His models sold fairly well; but as his partners severely forbade any experiments with self-propelled vehicles, about 1880 he left them, found a more liberal associate in Max Rose, and organized the Benz Company Gas Motor Factory at Mannheim. Working after hours, he designed a four-cycle one-horsepower motor, doubtless using his knowledge of the Otto. He increased the speed of the engine to 250–300 r.p.m., devised a fairly good carburetor, water-cooled the engine, and used an electric ignition.[23]

Benz chose a tricycle for his vehicle—again the influence of the bicycle world. The machine was light, and the single front wheel simplified the problem of steering. A system of belts and chains transmitted

power to the wheels. At first the car had only one speed, and the springs and brakes were very crude. Benz later asserted that he had made a test in the spring of 1885—apparently a limited one, with the vehicle still in process of development. However, on June 4, 1886, the *Neue Badische Landeszeitung* described the car, and on July 3 reported a successful test. "The whole velocipede is not much larger than an ordinary tricycle," it stated; adding, however, that "it should prove itself quite practical and useful to doctors, travelers, and lovers of sport."[24] Benz did not develop a second speed arrangement until 1887, when on April 8 he took out a patent for a sun-and-planet gear. He installed a three-horsepower motor, with better springs and brakes. It was undoubtedly this machine that was pictured and described in the *Scientific American* for January 5, 1889.[25]

Meanwhile, Daimler too had been active. On August 29, 1885, he received a patent for a motorcycle, the first vehicle to use his new motor. Though the machine was crude, being mostly of wood, in principle it anticipated the chief features of modern motorcycles, including the position of the motor, seat, and steering-gear; it had two speeds and could be put in neutral. Daimler's son Paul, according to Siebertz, rode three kilometers on this machine on November 10, 1885. It was thus tested later than Benz's tricycle, but was somewhat more advanced technically.[26] Apparently the motorcycle was merely a means of studying the adaptation of his engine to a vehicle, for in August, 1886, Daimler tried his first motor boat on the Necker River, and in the fall of the same year made tests with a four-wheeled carriage. The German patent on the motor carriage was received October 9, 1886, and a French patent on December 27, 1886.

The adherents of Daimler point out that his motorcycle patent was dated August 29, 1885, while Benz's tricycle patent was granted five months later—on January 29, 1886.[27] They argue that the tricycle was no more a true automobile than the motorcycle, to which the retort seems obvious that it was at least one wheel nearer!

The facts present a rather confusing pattern:

1. Daimler completed the first high-speed, four-cycle gasoline engine, more suitable than any other motor at that time for use in motor vehicles.

2. Benz appears to have made the first tests with a motor vehicle, but these are unauthenticated. Daimler received his patent for a motorcycle five months before Benz received his for a tricycle, and half a year before Benz's

first public tests with his machine; but Benz's authenticated tests are the first in point of time.

3. The tricycle was more like an automobile than was the motorcycle, and apparently operated more frequently and successfully; but Daimler was undoubtedly the first of the two to operate a four-wheeled, gasoline-driven carriage.

4. Daimler's machines both had two speeds instead of one, and his motor was undoubtedly superior to Benz's.

From these facts the reader can form his own judgment as to priority. Both men were pioneers, and the automobile can trace an unchecked development from the work of either. Both deserve high recognition. Although Marcus's second machine of 1875 may have been as good as or better than these German models of 1885–1886, it did not lead directly to a practical use of the motor car; their models did.

The appearance of these vehicles in 1886 excited talk and even alarm. It was a horse-and-wagon era. Benz was uncertain as to what rights he enjoyed on public thoroughfares, and finally wrote the officials of the province of Baden requesting permission to operate on the streets of Mannheim and the roads in the vicinity of the city. Permission was granted, but the inventor was warned not to exceed four and a half miles an hour in the city and nine outside.* Appalled by this order, Benz after desperately considering the matter, devised a stratagem which he hoped would modify it.

First, he invited the Minister of Transport to come to Mannheim and ride in his machine. To his joy, this invitation was accepted. He then arranged with one of his men to meet the minister at the station with the car. Meanwhile, he hired a milkman and his team to carry out a plan which was carefully rehearsed in advance so that it would not miscarry. The minister was duly met and was started on his way along the street. Soon the vehicle passed the milkcart, moving at a walk; whereat the milkman put his horses to a trot and clattered past the tricycle. As he did so he leaned out with derisive remarks about the "velocipede," urging its occupants to get a horse.

The minister was incensed. "Can't you machine go faster?" he demanded. "Can't you pass that insolent fellow?" "Certainly," replied the driver. "I can go faster than any horse, but by the regulations of the province we are restricted to six kilometers per hour."

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* To be precise, the order was six kilometers in town, twelve in the country.

"To the devil with the regulations!" responded the official. "I control transport and make them. Pass that fellow!"

Benz's employee put his machine into gear and sped past the milkman, the minister shouting exultantly as they shot into the lead. After this incident, Benz was permitted to operate his vehicle at any speed he liked. He could probably not have exceeded fifteen miles an hour anyway.[28]

4.

Although the horseless carriage, like the gas engine, had now emerged as a potentially saleable machine, the world evinced no eagerness to utilize it.

There were good reasons for its indifference. Though experimental machines of many types had been talked about, often wildly, for sixty years, the few that had actually run had not been convincingly efficient. The machines of Benz and Daimler were still full of defects, and doubtless were watched skeptically by technical observers who perceived their limitations, and by amateurs who instinctively felt them. In the United States no one heard much of Daimler or Benz for some years to come. As already noted, the latter's motor was not described until 1887 and his tricycle until 1889, while Daimler's engine was really not known in America until 1891, and then not as an engine for vehicles. Nothing indicated that either inventor was responsible for an epochal achievement. Gas and gasoline motors were now an old story in America, as we have seen, and gas-driven carriages were still regarded as experimental if not as visionary.*

As a matter of fact, far more interest was taken in vehicles powered by steam or electricity. Palmer's steam carriage in England and Bollee's in France were both being exhibited in 1886, and early in 1888 the *Scientific American* was able to report that Magnus Volk's electric tricycle with a forty-pound motor could do nine miles an hour on a smooth, hard road.[29] In the same year De Dion, Bouton & Trepardoux's steam tricycle attracted attention, while Messrs. Innsmith of London built a four-wheeled, four-passenger electric for the Sultan of

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* In February, 1891, an article on the Daimler motor appeared in the *Scientific American*, with an account of its variety of available sizes and uses. "Those adapted to boats and motor vehicles," runs one sentence, "differ but little from those applied to other uses." Thus the possible use of the engine in a carriage was casually mentioned. But Daimler, whose agent Steinway had a factory in Long Island, seems not to have tried to promote the motor for carriages in the United States, nor did he send any of his vehicles to this country for sale.

Turkey. "The carriage appeared to run very smoothly and to be under perfect control," commented *The Engineer,* "although the operation of backing was not shown during the time of our visit."[30]

For several years neither Benz nor Daimler pushed their motor carriages with vigor. Both men were doubtless occupied with reorganization for future operations.[31] Daimler in particular proceeded to lay a firm basis for his activities and to explore new possibilities. In the summer of 1887, he established a factory for his excellent motors, William Maybach, his right-hand man, supervising their construction. He was keenly interested in motorboats, which represented a much simpler problem than any vehicle and were more in demand by customers. He also constructed a gasoline-propelled fire engine, and adapted the motor to use in streetcars, again an easier task than the development of the automobile. A successful demonstration of a small model which ran through Cannstatt-Stuttgart on tracks which he had caused to be laid brought in orders, and his larger cars were soon appearing in numerous German cities and in Holland, Austria, France, Switzerland, and Italy. In 1890 he built a small gas locomotive which could haul several cars.*

Meanwhile Edward Sarazin, attorney for the Deutz Company in Paris, who had known Daimler while he was working at the Otto & Langen factory, paid a visit to the inventor, and in 1886 concluded an informal agreement to market all his inventions in France. Sarazin, after some difficulty in finding a French manufacturer who would push the products, and particularly the road carriage, finally encountered a responsive capitalist in Emile Levassor, who with René Panhard operated a wood-working and carriage factory at Paris.[32] Unfortunately in 1887 the attorney died, but before his death urged his wife to continue his activities. "You may have complete faith in his [Daimler's] work. It has a future beyond anything we can now imagine." Mme. Sarazin accepted this bold opinion, went to Germany, won a rather reluctant appointment as agent from Daimler, and concluded an agreement with Panhard & Levassor. They at once planned a carriage which would utilize the Daimler motor, commencing work in 1889.[33]

* [illegible] in New [illegible] [illegible]tomotive [illegible] street car [illegible] [illegible]g article [illegible] had introduced.
about their use in Switzerland and Germany, and the economies [illegible] [illegible] had introduced.

At the Paris Exposition of that year Daimler exhibited his motor not only separately but in two road carriages and a streetcar. The exhibits seem to have made no great impression on the crowds, the streetcar receiving attention chiefly as a convenient place to sit and eat lunches! Work in the Panhard & Levassor shops went forward, however, and without doubt was intensified by a strong infusion of romance: Levassor married Mme. Sarazin on May 17, 1890.

When a vehicle was finally completed and tested, it fell short of success. Levassor was not discouraged. "If Daimler can make his car go 18 kilometers an hour, so can I!" he declared,[34] and in the spring of 1891 produced a model which ran from Avenue d'Ivry to Point-du-Jour and back without the slightest trouble. Panhard & Levassor rapidly proceeded with both production and promotion, issuing a catalogue with prices for petrol vehicles in January, 1892, and the next October putting out a leaflet of testimonials from customers who had already successfully used the car.[35]

Thus five years or more after its first successful demonstrations the horseless carriage had fully arrived—but in France and not in Germany. Machines had been manufactured and sold in Germany, but not on the scale quickly attained by the Paris firm.

Benz meanwhile had also found a French ally in Emil Roger, who had used the Benz stationary motors in Paris, and who in 1887 visited Mannheim, bought a tricycle, obtained full selling rights, and made attempts to find customers. Since he encountered a prejudice against a German-named car, he soon designed a new model called the Roger-Benz, which he exhibited at the Exposition of 1889. When he took Emile Levassor for a ride in it, Levassor conceded that it behaved well, but decided that the Daimler motor and carriage offered greater possibilities. He was doubtless influenced by the fact that he could obtain exclusive rights for the Daimler products, while Roger controlled Benz's, and by his knowledge that Daimler had opened many more uses for his motors than had his rival.[36]

Roger, Panhard & Levassor, and the Peugeot firm in collaboration with Panhard & Levassor, sped the manufacture and popularity of the gasoline automobile. The thoroughfares of Paris and the chief French roads were fortunately smooth, well-paved, and broken by few steep grades. They permitted a use of the new vehicles that would have been impossible in the United States. Nevertheless, the carriages remained

on trial, still in need of improvements to make them relatively trustworthy and bring them into extensive use. Meanwhile, across the Atlantic inventors were ready to play a part in automotive history and would soon challenge the European engineers and manufacturers.

5.

On a pleasant summer night in 1892 a young man was diligently pedalling a bicycle from Salem, Massachusetts, to the neighboring town of Lynn. Hiram Percy Maxim, superintendent of a small factory in Lynn, had spent a pleasant evening with "an attractive young lady," but the hard hour's work to return home did not appeal to him. "The thought came to me that it would be a wonderful thing if a little engine were to be devised which would furnish the power to drive a bicycle. . . . I could not be expending more than a sixth or a quarter of a horsepower, and that would not mean much of an engine."

Young Maxim was an engineer, a graduate of the Massachusetts Institute of Technology, and the son of Hiram Maxim, inventor of the Maxim gun, who was then busy with experiments which he hoped would solve the problem of human flight. With such training and inheritance the cyclist did not permit his new idea merely to flit through his mind. He had often heard of the Otto gas engine, and had recently been told that one was operating a water pump near Lynn. Inspecting it, he was impressed by its apparent efficiency. He pondered how it might be adapted to a bicycle, and thought the obstacles would not be great. Of course, knowing something of the restless activities of the technical world, he suspected that other men might have worked upon the problem of adapting a gas engine to a vehicle. "Nevertheless, there were none of them running around on the roads. If I worked hard enough I might yet be first." Maxim set instantly to work to produce his own version of the horseless carriage.[27] Karl Benz had undergone a somewhat comparable experience almost thirty years earlier, while riding his *draisienne*. In America, a number of other men were already busy. Henry Ford had known a similar moment of illumination in 1876 when he saw a steam engine running along a road; he had held fast to the vision that had then been vaguely kindled in his mind, had sharpened it, and now, in 1892, was spending his after-hours in Detroit trying to devise a gasoline-propelled vehicle. Ransom E. Olds in Lansing, Michigan, who had been experimenting with steam road carriages

for some years, and as we have seen had built a fairly successful one in 1887, in 1892 decided that the gasoline engine must be the power plant for a really successful machine, and began to design one.[38] Elwood Haynes, now the field superintendent of a natural gas company in Kokomo, Indiana, had realized a little earlier that he was wasting valuable hours in driving horse and buggy to scattered points in his territory. Why not put a motor in some vehicle and accelerate his activities? This was no idle question on Haynes's part, for he had every right to assume that he could carry out such a project. At thirty-five he had as full a technical education, gained at Worcester Polytechnic in Massachusetts and at Johns Hopkins, as any American who dreamed of horseless carriages. As he read German easily, he may have been directly familiar [illegible] He had continued to show [illegible] for making carbon steel, and in [illegible] had invented a vapor thermostat.[39] In 1893, he arranged with the Apperson Riverside Machine Works in Kokomo to build a carriage of his design, and began making road tests to determine the tractive resistance of rubber tires—for the bicycle had affected his thinking.

Finally, Charles Duryea had concluded that the time was ripe for building the horseless carriage that Shanck's motor had suggested to him in 1886. An able machinist himself, he enlisted the help of his brother Frank, the two setting to work in Springfield, Massachusetts. Frank, twenty-one years old when the planning began in 1890, was at first only his brother's hired helper. "Charles had the idea," he stated years later, "and had certain plans drawn of a car." These included the design for a motor. But the older brother soon departed for Peoria, Illinois, where he was a partner in a bicycle-manufacturing business (again the bicycle!), and Frank was left to struggle alone with the numerous problems which arose when he tried to translate his brother's designs into an operable vehicle.[40]

Other Americans were similarly at work. Henry and Philip Nadig later asserted that in Allentown, Pennsylvania, they built workable gasoline engines as early as 1888, and three years later brought a car to the point where they successfully tested it.[41] Doubtless a dozen others were dreaming and tinkering; *Horseless Age* later estimated that three hundred had been at work! All these Americans except Olds were unknown to the public. Few were aware of European developments,

or knew how to make practical use of them.[42] Hiram Percy Maxim writes in his delightful reminiscences:

> As I look back, I am amazed that so many of us began work so nearly at the same time, and without the slightest notion that others were working on the problem. In 1892, when I began my work on a mechanical road vehicle, I suppose there were fifty persons in the United States working on the same idea.
>
> Why did so many different and widely separated persons have the same thoughts at the same time? In my case the idea came from looking down and contemplating the mechanism of my legs and the bicycle cranks while riding along a lonely road in the middle of the night. I suppose not another of us pioneers had his original inspiration come to him as mine came to me.
>
> It has always been my belief that we all began to work on a gasoline-engine-propelled road vehicle at about the same time because it had become apparent that civilization was ready for the mechanical vehicle. . . . It has been the habit to give the gasoline-engine all the credit for bringing the automobile, as we term the mechanical road vehicle today. In my opinion this is a wrong explanation. We have had the steam-engine for over a century. We could have built steam vehicles in 1880, or indeed in 1870. But we did not. We waited until 1895.
>
> The reason why we did not build mechanical road vehicles before this, in my opinion, was because the bicycle had not yet come in numbers and had not directed men's minds to the possibilities of independent, long-distance travel over the ordinary highway. We thought the railroad was good enough. The bicycle created a new demand which it was beyond the ability of the railroads to supply. Then it came about that the bicycle could not satisfy the demand which it had created. A mechanically-propelled vehicle was wanted instead of a foot-propelled one, and we know now that the automobile was the answer.[43]

This was a natural train of thought for Maxim to follow in retrospect, for he soon became an employee of the Pope Manufacturing Company, then the dominant manufacturers of bicycles in the United States. As we have seen, the able Civil War veteran Colonel Albert A. Pope, after going to Europe in the 1870's to observe the manufacture of bicycles, had begun in 1878 the production of American machines on an extensive scale.[44] Selling the Columbia and other popular types, he had soon begun to introduce into his plants standards and techniques which were to affect the automobile. In 1892, his company was already establishing a metallurgical laboratory and had organized 600 agencies

taught a class for machinists at the Detroit Y. M. C. A.[54] As he rose professionally he had more money for his experiments, and more opportunity to arrange time for them. He himself later declared that he had an "experimental room" at the Edison Company (probably in 1893, but possibly earlier) where he worked at night on his engines.

But a number of operable cars were finished before he succeeded in building one. The first was that of Charles and Frank Duryea, whose machine deserves more than a mere record of the date of its completion.

For the building of the Duryea motor-car, we have separate narratives by the two brothers. Charles E. Duryea made specific statements, long accepted but inaccurate, about the dates when it was designed and put into successful operation. "I began work in earnest in 1891 by getting out designs and taking steps to complete all parts of the vehicle," he testified under oath in 1914. Later he declared that the first run had taken place on April 19, 1892.[55] His date for the design is confirmed by his brother Frank; but according to Frank, experimentation occupied a much longer period, and success was not attained until much later than Charles wished to believe.

In his detailed, well-buttressed account, Frank fixes March, 1892, as the time when Charles persuaded Erwin F. Markham, a Springfield businessman, to advance $1000 to cover the costs of constructing a car. In return, Markham was to get a 10 per cent interest in the machine, which would rise to a half interest if he supported the project "to a successful issue." Charles then bought an old phaeton and engaged Frank, who was a toolmaker for the Ames Manufacturing Company in Chicopee Falls, Massachusetts, to help construct the car, adapting the phaeton by changes in the front and rear axles and the installation of a transmission unit. The motor was built according to Charles's specifications, which failed to include ignition, muffler, or means of starting . When the engine was tried out, it would not start; lack of a good ignition device seemed to both brothers the chief difficulty. Charles then left for his bicycle business in Illinois.[56]

The motor seems to have been a two-cycle model based partly on the old Otto & Langen free-piston engine and partly on a design by Edward Atkinson. Frank Duryea finally made extensive changes in it, combining a free and a working piston into a single unit, improving the action of the intake and exhaust valves, and devising a carburetor and a flame ignition device. Because his work was interrupted by an attack

of typhoid, it was February, 1893, before he was able to operate the engine and improve the uncertain transmission unit so that it was under fairly dependable control. During this period he had reported progress regularly to Charles, but had depended almost wholly upon his own judgment and the results of shop tests.

Frank could now drive the car back and forth in the loft of the Russell Manufacturing Company, where the work was carried on; a great advance, for previously the car, once started had been unmanageable, striking the wall and stalling. Doubtless the vehicle could now have made a run on the road, but partly because of the difficulty of taking it downstairs and partly because he knew it was in need of overhauling and improvement, Frank did not attempt an outdoor test.

Instead, he installed new parts, including a better piston and flywheel and an electric igniter, for which Markham supplied the money. In August the car was taken down to the street, hauled to a barn not far away, and made ready for a trial. This took place on or about September 20, 1893. The Springfield *Evening Union* of September 22 described a successful run, but explained that the transmission was unsatisfactory. It operated by means of a belt, which had to be shifted to change speed or put the car in neutral. "The inventors will do away with this belt in favor of a clamp gear," a gear and clutch transmission, it reported; and Markham finally agreed to pay for the materials on condition that Frank do the work without pay.[57]

Thus the initial public run of the car—the first American gasoline automobile—was made as summer ended in 1893, and not, as Charles Duryea had testified, a year and a half earlier. After the new transmission had been installed, the machine proved fairly dependable.

However, Frank Duryea could now envisage a still better carriage, and for some time vainly tried to enlist help in building it. Finally, after making a drawing of the new vehicle as he imagined it, with all machinery enclosed, he persuaded a new backer, H. W. Clapp, to finance the preparation of detailed drawings and the construction of the car. Charles Duryea came from Peoria and was given a ride in this new machine, which was still in the loft. Finding that the engine misfired at top speed, Frank designed a new four-cycle motor, took the car down to the street, and drove it with excellent results.

In general appearance the machine resembled a trim-looking buggy, with no machinery visible. It had wooden-spoked wheels with cushion

rubber tires, a water-cooled engine hidden in the rear, a cranking device, a clutch and gear transmission, and a lever steering apparatus. The engine possessed three forward speeds, a reverse, and a neutral position, and could furnish a speed of eighteen miles an hour. Altogether, it was a genuinely practical automobile. Before long it was driven nearly twenty miles over hilly, sandy roads to be shown to a potential investor, an expert on steam engines; and his enthusiastic report to friends led to the formation of the Duryea Motor Wagon Company.[58] Unhappily, the panic of 1893 had now precipitated grim depression; and as the press became filled with news of bankruptcies, unemployment, widespread misery, and fierce labor troubles, the outlook was far from auspicious.

Elwood Haynes early in 1894 completed his car and on July 4 made his first successful run; Ransom E. Olds had brought his gasoline-propelled vehicle to a point where it served as a basis for experiments; and Hiram Percy Maxim's projected bicycle had grown at the Pope Manufacturing Company factory into a four-wheeled carriage which had made some faltering excursions on the streets of Hartford. Olds had sold a steam-driven car to an Indian nabob. Several American road wagons driven by electricity, one of them completed by William Morrison at Des Moines in 1892, had made their appearance.[59] The World's Fair at Chicago had promised a showing for such models, and some were on exhibition.[*] The newspapers and still more the scientific journals manifested a growing interest in such novel forms of transportation.

The *Scientific American* quoted with approval on May 21, 1892, Olds' comment on his steam carriage: "It never kicks or bites, never tires on long runs, and never sweats in hot weather. It does not require care in the stable and only eats while on the road." Perhaps Gottlieb Daimler, who spoke and read English, saw this eulogy, with its implication that the horse had a rival of superior qualities. Several years later he wrote a jingle in German celebrating his own machine, part of which can be rendered:

> He never eats while in his stall,
> Drinks only when he starts to haul,
> Plays no dumb tricks that vex or tease

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[*] It has been stated by a number of writers that a Benz model was shown at the Fair, and by some that a Daimler was also exhibited. In a letter to Claude Sintz, April 20, 1940, Charles B. King asserted that neither was shown, and that the Sturges Electric was the only car at the Fair (Accession 80, Box 1, Ford Archives). This is probably correct. Detailed reports by the *Scientific American* on exhibits in 1893 mention *no* motor carriages.

Contracts no hoof-and-mouth disease,
Raises no angry heel to kick,
Nor raids your standing grain, or rick—
So buy this beast of happy ways
And live in clover all your days![60]

By 1895 machines were a reality in both Europe and America, even though by modern standards crude and unreliable. The public still withheld judgment, but waited only for some spectacular and convincing demonstration.

7.

The world had not long to wait. On July 19, 1894, a "competition of carriages without horses" was held in France for prizes offered by the *Petit Journal*. The route was from Paris to Belfort and return, and so efficient had the European promoters of motor transport become that seventeen competitors started the first day, six on the second, and two on the third. Fifteen carriages finished the course, a De Dion steam car making the best time, 5 hours and 40 minutes, but being nearly tied by the petroleum-motored Peugeot. A Panhard & Levassor was fourth.[61]

The following year, on June 11, a much longer race was run from Paris to Bordeaux and return, 727 miles. On this occasion the superiority of the gasoline-motored vehicles was clear. A Panhard & Levassor made the fastest time, covering the first leg in 22 hours 28 minutes, or 15 miles per hour. As a two-passenger car, however, it was ineligible for the first prize, which Peugeot Brothers took: 31,500 francs offered by James Gordon Bennett, Baron de Neufeldt, and others. Even the *Scientific American,* partial to steam and electricity, conceded that the gasoline-driven vehicles had now come to the front: "Upon the whole, it was the lightest vehicles that behaved best on the road, and this fact, now universally established, proves the superiority of gasoline and naphtha over any other motive power at present known."[62]

Europe was convinced that the automobile had arrived; the United States was prepared to believe it, but wanted its own demonstration. This was made possible by the Chicago *Times-Herald* and its owner Herman H. Kohlsaat, who arranged for a race of horseless carriages on November 2 from Chicago to Milwaukee, with prizes of $2000, $1500, $1000 and $500. At the request of contestants who needed more time, the race was postponed to Thanksgiving Day, November 28, 1895, while the distance was reduced to 52.4 miles, from Jackson Park

to Evanston and return. Pending this, two entries, a Benz car driven by H. Mueller of Decatur, Illinois, and Frank Duryea's American car, ran a race over a 92-mile course from Chicago to Waukegan and return. Unfortunately, the Duryea car was involved in an accident, Frank Duryea running it into a ditch to avoid colliding with a farmer and his team and breaking the differential housing. The Benz went on to win in 9 hours and 30 minutes.[63] But the Duryea car still had an opportunity to compete in the regular race; it was hastily repaired at Springfield, Massachusetts, and returned in time for the bigger event.[64]

This proved a severe test of the varied assemblage of horseless carriages.[65] Midwestern winter had descended with a foot of snow, clogging the roads. The temperature ranged from 30 to 39 degrees. Five of the eleven entrants did not start, although in one instance, that of the Haynes-Apperson machine, failure was caused by an accident on the way to the starting point.[66] The six competitors who appeared were forced to drive "through deep snow, and along ruts that would have tried horses to their utmost," according to the *Times-Herald* report. Actually only three cars made a race of it. The Sturges electric carriage and the Morris Salom electrobat both dropped out after short runs, while the La Vergne, an adapted Benz, soon quit because of the snow. This left the Duryea, Mueller's Benz, and an adapted Benz entered by the R. H. Macy Company. At one point in the race the Macy was in the lead, but drew aside in accordance with the rules to let the Duryea, which was pressing close behind, pass it. "The groups of spectators along Forest Avenue applauded the unusual sight of one horseless carriage forging ahead of a rival," wrote a reporter.

The Duryea had started at 8:55 A.M., the Macy at 8:59, the Mueller at 10:06. Each car had a driver and an umpire. About the half-way point the Macy car dropped out. Duryea kept well in the lead, and finished first after night had fallen, at 7:18 P.M. Mueller arrived more than an hour and a half later, but only as a passenger, for he had collapsed from strain and exposure, and Charles B. King, his umpire, finished the race for him. While Duryea's average running speed was only 6.66 miles per hour, the weather had been execrable; and it was agreed that to finish the race against such obstacles was an achievement that promised more for the future of the motor carriage than a fast run under ideal conditions.[67]

The race gave a great impulse to American automotive activity. To be sure, the difficulties to be overcome before the motor car could be

considered established were so numerous that even enthusiasts were cautious. "We require in the horseless carriage," wrote a reader of the first automotive magazine, "a mechanism so simple as not to get out of order easily or give trouble to the unskilled operator, and a carriage so arranged as to be comfortable in use, viz., it should be clean, free from objectionable odor, vibration, or possible danger."[68] No existing model, not even Duryea's, could as yet meet these conditions. Furthermore, the gasoline-propelled vehicle still suffered from the lingering trust in steam. "There can be little doubt," wrote an expert two years later, "that the vast majority of people would prefer a smooth-running, reliable steam engine for use as the propelling medium of a pleasure or light business carriage, to the evil-smelling, dangerous, wasteful, and at best uncertain and unreliable engine heretofore chiefly employed for that purpose in motors of recent construction."[69] Hundreds of dubious or even unfavorable comments could be quoted to show that long after the Chicago race a strong skepticism existed concerning the future of the automobile.

A multitude of determined men, however, including many inventors and technicians, scorned such reservations, cherishing a firm faith in the future. The race had brought together a number of such men. They regarded the victory of the American car over the various Benz entries as right and natural; for they were sure that American enterprise, despite the tardiness of Yankee inventors in getting into automotive development, would quickly achieve a strong competitive position. Their faith was doubtless strengthened by meeting each other and seeing the encouraging results of American activity. One evidence of their vision and confidence was the founding on November 1, 1895, of the American Motor League, the first automobile association in the world, with a charter membership which included Duryea, Haynes, Salom, Morris, C. F. Karns, and Edward E. Goff. It had been suggested by Charles B. King, a devoted believer in the motorcar, in a letter of October 8, 1895, to the *Times-Herald*.[70]

But progress could depend only in limited degree upon associations or periodicals. It would have to be planned, machined, hammered, and tinkered out in the dozens of sheds and shops all over the East and Middle West where earnest mechanics were trying to bring new models to birth, or, in several instances, laboriously turning out a few cars for sale. Already, in 1895, Henry Ford was immersed in this activity, and he was soon to make it the dominant passion of his life.

VIII

A HORSELESS CARRIAGE

After supper on Christmas Eve, 1893, Clara Ford was busy with preparations for next day's dinner, to which her family, the Bryants, were coming from Greenfield. The Fords had recently moved into half of a two-family house at 58 Bagley Avenue, Detroit. Edsel Ford, born November 6, and so seven weeks old, was sleeping in an adjoining room.[1]

Henry had been working on a simple experimental engine. After reaming out a length of one-inch gas pipe for his cylinder, he had fitted into it a home-made piston attached by a rod to a crankshaft. The piston had a five-inch stroke. He had equipped his engine with a makeshift flywheel taken from an old lathe, and with a gear which operated a cam, opening intake and exhaust valves and timing the electric spark.

He now brought the engine into the kitchen, mounted it on a board, and clamped it to the sink, for he wished to use the house current for his crude spark plug, and to test his motor. The gasoline had to be fed into the intake valve by hand, and since he would have to spin the wheel to start the engine, Clara's aid would be needed. It can be seen that the little engine was rather in an experimental than a formative state, lacking as it did both a carburetor and an ignition system.[2] But if the partially built mechanism would run, Henry could design and build the remaining elements later.[*]

Clara's perturbation at the intrusion of the model into her kitchen can be imagined. But after all, she was a Believer. While Henry fin-

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[*] This account is generally accepted by the Ford family, and was essentially repeated by Henry Ford himself in an anonymous but carefully prepared record of an interview in Accession 1, Box 118, *Ford Archives*. According to Simonds, Ford had "a piece of fiber with a wire through the center" which made contact with "another wire at the end of the piston." When contact was broken, a spark resulted. In a car, Henry would have had to supply current from a battery, but for a test he could use the house current.

ished setting up the engine, he explained how she could splash the gasoline into a metal cup which acted as a crude carburetor, and feed it into the intake valve by turning a screw according to his instructions. She dripped the first installment, and twisted the screw. Henry spun the flywheel. This action sucked a mixture of gasoline and air into the cylinder. The kitchen light flickered as a spark was delivered. The engine coughed; another spin and it began to whirl, flames coming from the exhaust valve and the sink shaking. Henry Ford watched it for several minutes, then waved Clara away, and let the motor die. It worked. That was all he wanted to know.

"I didn't stop to play with it," he said years later. "I wanted to build a two-cylinder engine that could be used to propel a bicycle." He was now ready to begin work on this.[3]

2.

After first establishing themselves at John R. Street, the Fords had changed residences several times. In the summer of 1892 they seem to have occupied a room let them by a partner in the Seinzer Furniture Company, with which Henry Ford had dealt while operating his saw mill.[4] By October they had removed to 162 Cass Avenue, and by May, 1893, had installed themselves in a flat at 570 Forest Avenue, for which they paid $15 a month. Here, Henry's and Clara's first and only child, Edsel—named for Henry's old schoolmate, Edsel Ruddiman—had been born. The Fords remained at this apartment until December.[5]

By this time Henry had become chief engineer for the Edison company, whose main plant and offices were at Washington Avenue and State Street, a little northwest of the City Hall.[6] The winter of 1893–94 was so severe that he found it difficult at times to get from home to his new place of work. Clara perceived the desirability of a change; and when Henry found quarters on Bagley Avenue, and proposed to have the moving men pack, transport, unpack, lay the carpets and put up the curtains, she consented. On December 15 the family was established in its new home, only a block or two from the plant.[7]

On the rear of the lot stood a small brick building for the storage of wood and coal, each family in the double house using half of this substantial shed. Henry at once established his experimental workshop in the part assigned to him, and began to push work on his engine.[8]

Not long before, Ford had met a young engineer and inventor who

was to have no small influence on his work. Charles B. King had opened an office late in 1893 or early in 1894 on the second floor of the new building that John Lauer had occupied for his machine shop the preceding year. King, the son of General John Haskell King, had been born at Camp Reynolds on Angel Island, San Francisco Bay, in 1868. "Mine was strictly an Army boyhood, living in one Army post after another," he wrote in 1945. When General King retired in 1882 he brought his family to Detroit, Mrs. King's girlhood home. Charles had early shown a mechanical bent, which his father never discouraged. As we have seen, the youth had worked in shops during vacations, acquiring considerable practical experience. After completing high school, he entered Cornell in 1887 to study engineering, and during his less than two-year stay received a sound training in mathematics, science, and laboratory procedure. Then, leaving in 1888 because of his father's death, he took a post as draughtsman with the Michigan Car Company in Detroit.

King did not long confine himself to a draughting board. He was soon dealing with emergency problems and helping design new types of railroad cars. More important, in 1890 he invented a pneumatic hammer, which he continued to improve; while in 1893 he devised the King Steel Brake Beam, which was exhibited at the Columbian Exposition at Chicago and later became standard railroad equipment. He went to the Fair himself, taking charge of the Russell Wheel & Foundry Company exhibit. Entering his own pneumatic hammer, which at the time was unique, he won a bronze medal and a diploma—the highest possible award.

At the exposition King studied the Sintz gasoline engine, and in July, 1893, ordered one with the idea of testing it in a road carriage. The Sintz company, impressed by the young engineer, invited him to represent it in the *Petit Journal* race of 1894, but King realized that he could hardly build a vehicle in time, and in any event lacked funds. Nor when, returning to Detroit, he experimented with the Sintz engine, did he find this an adaptable power unit for a road carriage—although somewhat later Elwood Haynes utilized it. Discarding the Sintz, King planned a two-cycle, two-cylinder motor of his own. His notebooks show designs made as early as October, 1893, for adapting a motor to a bicycle and (in December) to a four-wheeled vehicle. Early in 1894 he improved these plans, but before the end of that year

had discarded them and was working on a new four-cycle, four-cylinder motor for his projected carriage.[9]

Soon after his return from Chicago he organized the Charles B. King Company and established quarters in the Lauer building at 112–114 St. Antoine Street.* He had sold his brake beam patent to the American Brake Beam Company of Chicago, had a promising outlook for marketing his pneumatic hammers, and planned also to design and sell marine engines. Lauer was to manufacture for him. Thus King was just the man who could inform, broaden, and stimulate Henry Ford; and the two met late in 1893 or early the following year, when Ford as chief engineer for Edison came on occasion to the Lauer shop to have work done. An acquaintance deepened into friendship. When they talked of their interest in motor vehicles, Henry told of his ambition to build one. "He asked me to give him a hand," King recalled many years later. "Of course, I was willing."[10]

Early in 1894, but after he had come to know Henry Ford, King employed a German-American youth of seventeen, Oliver Barthel, to assist him. Though born in Detroit, Barthel had spent some years in Germany, where his father was an agent of the Michigan Stove Company. Later his mother had returned to America with him and his two brothers, and he had just finished high school and began to study mechanical drawing, machine design, and engineering in Detroit, when his father's death forced him to seek work. He nevertheless continued his studies by night. At the Y. M. C. A., where he enrolled in a class in machine shop practice, he was taught by Henry Ford, whom he considered just an average instructor.

King and Barthel got on well together. The former could and did teach his assistant much; at the same time he was never dictatorial or dogmatic, and was always receptive to new ideas. "I have never worked so well with anyone," Barthel declared. In the Lauer shop most of the employees were Germans or German-Americans, and some spoke little English. Fluent in German, Barthel was able to expedite whatever work the Charles B. King Company had in process.[11] He also got on well with Henry Ford, whom he recognized as a capable machinist. Young Barthel was keenly interested in problems of personal development, and discussed them with the Edison engineer. Later he felt that

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* The visitor to Detroit will find a plaque noting that the first automobile produced and operated in Detroit was constructed there.

certain books which he owned, notably Orlando Jay Smith's two volumes, *A Short View of Great Questions and Eternalism: A Theory of Infinite Justice,* had a profound effect upon Ford.

Barthel joined King in time to work on both the two-cycle and four-cycle motors, and on the adaptation of these to road carriages.* King later declared that he could have operated a motor-propelled vehicle late in 1894 had he possessed enough money for its construction, and Barthel agreed with him.[12] King was receiving an income from the sale of his hammers, but this was not enough to finance highly expensive experimentation.† Moreover, he went about not a little with John Newberry and Henry Joy (later associated with the Packard Company) who moved in what was called Jefferson Avenue society. They spent money freely, and King found the pace they set somewhat difficult. He could not persuade these "swell friends" to help him finance his automotive experiments.

By the summer of 1895 King believed that he could complete his car for the Chicago *Times-Herald* motor carriage race. He entered it: the only car from Michigan, as he later pointed out. But in the autumn he perceived that he had been too optimistic, and withdrew. He was then invited to serve as an umpire. Henry Ford doubtless had a first-hand account from King of all aspects of the great race: the cars that appeared, the cheering crowds, the breakdowns, and the young umpire's experience in driving for Mueller. King must also have told him about the formation of the American Motor League. Henry's determination to produce a car of his own was thus sharply fortified by King's account of the activities of others. King himself was at white heat. When Mueller graciously offered him some of the prize money, he would have none of it, accepting only a gold medal. "It wasn't money I wanted," he told a writer for the *New Yorker* fifty years later, "it was to do things. I was bursting with ideas—bursting!" The seventy-eight-year-old pioneer, says the writer, leaped from his chair and paced about at the memory of his enthusiasm of fifty-one years earlier![13]

We now come to a difference in testimony on Ford's activities. He,

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* Barthel states that the two-cycle motor was too heavy and too costly. "By making a four-cycle we could get a lighter engine per horse power, and one that didn't cost any more—in fact, it didn't cost quite as much."

† Charles B. King Papers, cited above. In a final interview with Dr. Milo M. Quaife (see note 10 above) King with the tendency of many inventors (Ford, Charles Duryea, Olds) to pre-date accomplishments, said that in the summer of 1894 he had a car that would do 20 miles per hour. Asked why *then he had* not been able to participate in the Chicago race a year later, King commented, "That is a thought."

his wife, and his sister agree (although Margaret Ruddiman was guided entirely by what Clara told her at various time) that he had tested a model gasoline engine on December 24, 1893. According to Marvin Buckberry, Ford began work on a larger, two-cylinder motor of the same general type five days later.[14] Yet King tells of a one-cylinder engine—"more of a toy than a practical device"—being clamped to the kitchen sink of the Bagley Avenue house late in 1895, when Edsel was about two years old. "This was his first gasoline motor." King claims to have been present at the initial trial, and describes Clara's perturbation. "She had baby Edsel sleeping in a crib in the next room, and she was afraid the gasoline fumes would poison him."[15]

Barthel states that he showed Ford an article in the *American Machinist* for November 7, 1895, which explained how to construct a gasoline engine from odds and ends. Ford became interested and decided to build one. By implication, this was his first engine. George W. Cato, an Edison Company employee in 1895–96, appears to have told King that Ford had shown him a picture of a small motor in the *Machinist*, saying that "a barrel of money was to be made in it," and urging Cato to join him in building a similar engine.[16]

Was the first experimental model constructed in 1895 rather than in 1893? This would be credible, for Ford, like Charles Duryea, King, Olds, and others, tended later to pre-date his experimental work. However, we have both Henry's and Clara's assertions that Ford came to Detroit to work on a horseless carriage, and was working on it in 1893, if not earlier, and made his first engine test on Christmas Eve of that year.

In addition, we must give some weight to Ford's ability as a machinst and practical engineer in combination with his known ambitions. We have seen that he was highly recommended at about this time by a number of manufacturers and executives. Alexander Dow, later President of the Edison Illuminating Company, described him as "very resourceful," and told how he saved the Edison engines from sinking into a pocket of quicksand by driving wedges beneath them over a six-week period.[17]

It is difficult to believe that a man of Ford's skill, experience, and energy should have repaired an Otto in 1885 and studied various other models, including the one which prompted him to come to Detroit, and yet more than four years after his arrival have done nothing in the

area of experiment which was professedly his reason for leaving the country.

It is possible that King and Barthel and Cato testified to actual happenings, and yet did not see the beginnings of Ford's activity with gasoline engines. Simonds says that the larger two-cylinder model started late in 1893 did not prove suitable.[18] King does not date Ford's request for help, and this may have come to him in 1894 or in 1895, after Ford had encountered difficulties on his work. However, the exact pattern of Ford's activities in the years 1892–1895 are not of great importance. The important fact is that they resulted in no operable motorcar. The crucial achievement came in the period beginning late in 1895.

3.

King was now nearing the point where he could look forward to operating his own gas-propelled vehicle.

The moment seemed auspicious. Detroiters had heard of the first spectacular European races, and of a motor carriage exhibited at the World's Fair. On August 10, 1895, the *Evening News* carried an article entitled "A Horseless Carriage," which was illustrated by a cut of the Sturges electric. Comments on the forthcoming Chicago race and the Paris-Bordeaux contest of the preceding year show that both events had by now been well publicized. On September 29 the *News-Tribune* predicted that "a horseless vehicle" would soon be seen in the city, in all probability electrically propelled. The same paper on November 3, 1895, described in Defoe-like detail the astonishment of police and bystanders at the appearance of two motor carriages alleged to have raced at night on the Detroit streets. Several cyclists pursued the strange machines, marvelling at their noiseless motors and the gleam of steel chains under the bodies, but were left behind. "The distance between the pursuing bicyclists and the horseless vehicles lengthened, there was a whir of electric sparks at Milwaukee Avenue [the machines were coursing up Woodward], and like some blazing comet that had shot across the sky only to disappear again in space, the two unaccountable creations were lost to view." The narrative may have been based upon some unknown test, but more probably can be traced to the imagination of a reporter familiar with Poe and Jules Verne.

King was only a few weeks' work from the possibility of participa-

tion in such a weird race, but imagination was not what he needed. Returning from Chicago "bursting with ideas," he had his four-cycle, four-cylinder motor and practically all of the chassis for his car in readiness, but was being held up by a shortage of money and at least one important item—the complement of three-inch, single-tube pneumatic tires which had been ordered from the United States Rubber Company. Apparently they had to be specially made. "Because we were unable to get the tires," declared Barthel, "that machine stood up in the shop without tires."[19]

Some time early in 1896 King was offered a wagon by the Emerson & Fisher Company of Cincinnati. "That firm of carriage builders," King recalled, "had been considering self-propelled vehicles without arriving at any practical result, and in the hope of getting somewhere loaned me an incomplete, experimental, iron-tired wagon with full privileges to reconstruct it for testing."[20] Apparently his own chassis was not so near completion as Barthel has indicated, for King took the wagon and installed in it his four-cycle, four-cylinder engine. This engine had its brass water-jacketed cylinders cast *en bloc,* perhaps the first so designed and produced; it had electrical ignition and oil lubrication. Apparently the transmission of King's own carriage was used, or one like it made. Describing the vehicle later, Barthel emphasized the fact that the vehicle was not King's or his idea of a finished job. "That wasn't a car; it was a testing wagon. We merely built it to have something to test the engine in."[21]

By March 1 the testing wagon was ready, and was operated several times at night on the Detroit streets. Then on the 6th, in the evening, King announced a public demonstration. The Detroit papers of March 7th and 8th noted the result. "The first horseless carriage seen in this city was out on the streets last night," declared the *Free Press.* The *Journal* pronounced the wagon "a most unique machine." It added that "when in motion the connecting rods fly like lightning, and the machine is capable of running seven or eight miles an hour." The car was credited with delivering three horsepower, and its weight was given as 1300 pounds. King told the reporters that he would build a five-horsepower car, and that he would soon have a carriage for sale. He spoke of the increasing use of motor vehicles abroad, and of the fact that the Prince of Wales had ordered one. "They are much in vogue among the English aristocracy, and will undoubtedly soon be

here. One of my carriages will take part in the Cosmopolitan race in New York on May 30, and another at Hamilton, Ont., on July 1. I am convinced that they [i.e., motor carriages] will in time supersede the horse."[22]

Now that a horseless carriage *had* appeared in Detroit, the press gave a surprisingly small amount of space to the event. The *Journal's* account, the longest, occupied hardly a quarter of a column; the *Tribune,* a day late, devoted only three lines to it, although it had spread its lurid narrative of the mysterious vehicles of the preceding November over more than a column![23] King was probably disappointed. Lacking funds to push his experiments, he failed to enter cars in the two races he named.

"Mr. King didn't give up the idea of building a horseless carriage," Barthel later pointed out. "He merely postponed the idea because he didn't have the means to go on with it."[24]

King did make a sale not long after his demonstration, disposing of the chassis of his own carefully designed model, which still lacked its diamond tires, to Byron D. Carter of Jackson, Michigan. Carter, who had charge of the machine shop at the state prison, later got Barthel to design a motor for him (probably much like the power plant King used in the test wagon), and had it built in the prison shop.[25] "To some extent, but not entirely," King wrote later, "this car [the chassis he sold Carter] became the model for the Cartercar, a pioneer friction-drive car which figures in General Motors history."[26]

King undertook other automotive activities, some of which will be noted later. But he did not assume the role that might have been his had he been able to find financial support for his ideas and demonstrations. It is regrettable, for of all the early builders, even including Haynes, he had the soundest training for motor and machine design, and the imagination and drive to be a great leader. When after some years he was able to use his talents effectively, he made notable contributions, but by that time many others of comparable expertness were active in the field, and the gleaming opportunities of the mid-1890's no longer existed.

4.

When King made his public demonstration on the evening of March

6, a wiry, mustached cyclist followed the wagon about, intently watching its behavior.[27] Henry Ford, while keenly interested in the work of his friend, was also eager to learn what he could about the vehicle in action—the first propelled by gasoline that he had ever seen. He was then well along with the task of building his own motor and carriage.

Ford was thirty-two years old. He was highly proficient as a mechanic and as an operational engineer (though not like King an engineer with the mathematical, laboratory, and theoretical background increasingly in demand for the solution of professional problems). He held a good job, he was ambitious. Still, he had as yet accomplished nothing notable—nothing comparable with what Frank Duryea had achieved at twenty-five, or even what King had now done at twenty-eight: a pneumatic hammer, a railroad brake beam, and a motored wagon that ran with encouraging success. However, Ford seems not to have been disturbed by the motor carriages that others had built. Doubtless he perceived that all of them were cars in the making, that almost infinite room was left for improvement, and that he would have his opportunity to make a contribution.

The Henry Ford of this period was an engaging as well [illegible] an energetic young man. A photograph of a group of Edison workers shows him with a twinkling eye and a liveliness of countenance that are attractive.[28] Stories about him that have come down to us from these days prove that he had an abounding vigor and a streak of fun as marked as any he showed when he plagued his brother and sisters on the farm with his practical jokes.

"Jim" Bishop, a fellow employee at Edison and one of Henry's helpers after hours, later recalled a prank that Ford played on a crew one night. Bishop and several others were repairing an engine in the old Tolsma Building. Suddenly they realized that they were breathing with difficulty, and smelled a strange but unidentifiable odor. Hastening outside, they discovered Ford and another Edison employee dropping sulphur on [illegible] shoveful of hot coals and blowing the fumes with a bellows through a knothole into the room.[29] Another story relates to one of the men in the engine room of the plant, George Flint. He had a habit of leaving his tools and even working clothes scattered about the place. This offended Ford's love of neatness. When Flint left his shoes in the middle of the floor one night, Henry took up a

board, drove long spikes through the shoes and clinched them on the under side, and then nailed the plank back in place.[30]

But Henry's liveliness did not interfere with his after-hour activities. In a sense, it made them possible, for vitality was needed for the regimen he now adopted. To the little workshop at the rear of 58 Bagley Avenue he retired nightly to labor until eleven o'clock, midnight, at his self-imposed tasks. Even there he was not free from the plant—an extension telephone in the shed permitted him to be reached in a moment in case of an emergency.[31] But he did not mind the long hours. "I cannot say that it was hard work," he observed years later. "No work with interest is ever hard." He was confident of results—"They always come if you work hard enough." He had the tirelessness of a machine; and Clara's firm belief in him helped to provide serenity and confidence. "It was a very great thing to have my wife even more confident than I was. She has always been that way."[32]

According to Barthel, Ford did not begin work on the larger motor for his carriage until well into January of 1896. In the issue of *The American Machinist* for January 9 appeared a second article on a gasoline engine, accompanied by detailed drawings. Barthel says that Ford started work on his engine at the Edison plant with this magazine article as a guide, and that he, Barthel, dripped gasoline into the cylinder, but that Dow objected to such activity as a fire hazard, and that Ford shifted operations back to Bagley Avenue. The engine described in the January 9 issue was a Kane-Pennington. This, asserts Barthel, became the power plant for the new car.[*]

In any event, Ford was now building a four-cycle motor with two cylinders of 2½-inch bore and six-inch stroke, which generated from three to four horsepower. A little later, work commenced on the body of the car.

He had help both with the motor and the vehicle.

As to the former, one of his chief difficulties was with ignition. Cato, whom he had tried to interest in building a motor, was an electrician. Ford had a basement room next door to the Edison plant—not in it, as Barthel recalled.[†] Here both Bishop and Cato assisted him with the

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[*] Barthel, *Reminiscences*, Ford Archives. It is difficult to see how Dow could have objected to the work (which as we shall see was not at the Edison plant), for Dow did not come to the Edison Illuminating Company until July 1, 1896.

[†] David M. Bell, *Reminiscences*, 9. Ford Archives. Bell, who later worked in this "shop," says it was next door to the Edison plant. His statement is borne out by an undated and unidentified letter in the Ford Archives, written to "Dear Sam" and signed "O. C." The writer

building of the engine. "Mr. Cato was a natural born mechanic with no superior," Bishop stated many years later, "and a consultant of Mr. Ford during the building of the car and afterward."[33] Cato worked out the ignition problem. He devised two "ignitors," as Bishop called them, of the make-and-break type, one for each cylinder.[34] The three men, with "Spider" Huff perhaps helping at times, made other changes from the magazine model. All automotive pioneers took what they could from existing engines: the Duryeas borrowed from the Otto and the Atkinson; King and Haynes from the Sintz; Olds from the Otto; but all were forced to adapt and adjust, and to work out many details for themselves. Ford wanted an engine that would work, and he built a better one than the Kane-Pennington, a model which King despised.[35]

As for the rest of the carriage, Ford undoubtedly learned much from King, for he was present while the latter was developing his test wagon at the Lauer shop. "He could see what was being built there," remarked Barthel. In particular, King discussed transmission with Ford. This was perhaps after the appearance at the Detroit Horse Show in April of the Duryea machine which had won the Chicago Race. King had probably arranged to get this vehicle, for he had redesigned an engine for Charles Duryea, and was building a few for the Duryea company.[36] At the Show he demonstrated the carriage. The Detroit *Free Press* of April 19 heralded the coming of the car, and on April 24 described and praised it. Although nine years later Ford testified that he had seen a Duryea in 1893 or 1894, this was impossible, as none had at that time ever left Massachusetts; his sight of it at the Detroit Horse Show was his first. Ford seems to have observed the transmission used, and to have consulted with King about it; on May 27, 1896, King, according to his diary, procured a ten-foot length of drive chain for Henry from the Indianapolis Chain Company.[37] It would seem that Ford had orig-

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says that the quarters were owned by the Tolsmas, who offered it to Ford free, but when he insisted on paying, charged him seventy-five cents a month. The letter, written when Henry

frivolous about ours. . . . At three or four or five o'clock in the morning we would roll around to State Street and very often find Uncle Henry ready to kid us a little."

inally used a belt transmission, then changed to a part-belt, part-chain device. He also installed a compensating gear which permitted the same power to be applied to each of the rear wheels in turning corners.[38]

The chassis and body of the quadricycle, as Ford called the car, were built in the Bagley Avenue shop, where Bishop was his helper. "Mr. Ford and I worked every night on this car for a long time before completing it," Bishop recalled.[39] Edward S. ("Spider") Huff worked with them.[40] King, Barthel, Cato, Bishop, Huff—Ford picked up consultants and helpers where he could. The characteristic noted by his sister Margaret when as a boy he directed the building of the water wheel and the steam turbine at school ("He only told them what to do and they very willingly did it") emerges again, very significantly. It was his instinct, in the drive toward his dream, to harness anyone who could help pull him in that direction. He would continue the practice throughout his life, and the corps of advisers and workers would grow in size.

The general character of the carriage as it developed toward final form showed originality and anticipated later Ford practice. In contrast with King's wagon it was strikingly small and light—the lightest vehicle of its type yet produced.* The entire machine without fuel would, when complete, weigh only 500 pounds. Seeing it in pictures or at the Henry Ford Museum in Dearborn we can imagine a man picking it up, a feat quite possible if the motor were removed. It ran on bicycle-type wheels with pneumatic tires. The frame Ford and Bishop constructed, getting the necessary materials as the work progressed. Their car was less like a buggy than any other model to date, even the seat being a bicycle saddle; but when later this was removed and a light carriage seat for two substituted, with a straight dashboard, it had more of the buggy look.[41]

Ford provided two speeds, one ten and one twenty miles an hour, and a neutral gear. Changes were effected by a clutch lever which tightened or loosened a belt. Pulled back, this lever put the car in low; erect, in neutral; forward, in high. Later the belt was discarded and gear shifts substituted. The motor had a flywheel, spun in neutral to

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* It will be remembered that King's test wagon weighed 1300 lbs., somewhat heavy for an early gasoline carriage. The Duryea of 1895, according to the *Scientific American* of December 7 of that [illegible] *raphy*, XXV, 13.) Columbia Electric [illegible] added; still, even [illegible]

start the engine. To stop, the machine was again put in neutral and the brake applied: for a while the car had none, but a foot-brake was soon provided. There was no reverse.[42]

The builder procured materials from various Detroit firms. "Most of the iron work," he testified in 1904, "was got from a firm by the name of Barr & Dates; they were located at that time on the corner of Park Place and State Street, Detroit. The wheels I made; the seat I got from the Wilson Carriage Company, and from C. A. Strelinger & Co. bolts and screws and nuts; I made the handle myself; I don't know where I got the balance wheel from; I made the pattern and got it cast; I made the sparking device; the springs from the Detroit Steel and Spring Co."[43] King contributed four intake valves which he had discarded in the process of building his four-cylinder motor.[44] When Ford speaks of making something himself, quite obviously he includes the work of Bishop, Huff and Cato done under his supervision; as we shall see, a number of the metal parts were made later by a fourth assistant.

According to King, Ford was sometimes hard-pressed for money with which to buy the materials he needed, and his credit at "a local house" (presumably Strelinger's) was only $15. Charles T. Bush, then an employee of that firm, seemed unaware of any such restriction when telling years later of Ford's relationship with the house,[45] and Barthel did not think that Henry was ever hard-pressed financially. "He was working, he had his pay coming in."[46] Although Clara Ford mentions no limitation on credit, she recalled that the materials for the car ate up all the family's surplus above expenses. "It seemed as if we would never have any for ourselves."[47] Telling Henry's sister Margaret about drawing out money needed for the quadricycle, she recalled wondering more than once if she would ever live to see the bank balance restored. "Her only concern then," said Mrs. Ruddiman, "was the immediate one that Henry needed parts for his work. She wanted to be sure that there was sufficient money in the bank to pay for them."[48] These comments indicate that building the little carriage was a financial strain on the family. No wonder; King, by no means hard-pressed for money, had been forced to suspend activities because experimentation was too costly, and the Duryeas ran through three sets of backers.

Ford went on working, happy to see his dream taking tangible form. The other occupant of the double house was Felix Julien, who of course

was entitled to use half of the little brick shed in which the carriage was being constructed. A friendly man of advanced years, he soon became much interested in it, perceived that the half of the building being used as a shop cramped Ford's activities, and insisted finally on tearing down the brick partition which divided the shed, storing his own wood and coal in his house, and thus giving his neighbor more room. He would then sit and watch the progress of the work.[49] There were few other observers—King, perhaps, and Barthel and Cato. In this period Clara's cousin Nettie Bryant Scott and her sister, Kate Bryant, were sometimes staying with the Fords. Clara puzzled both girls by making nightly visits to the little shed, always alone. "Henry is making something, and maybe some day I'll tell you," she told them. "Well," recalled Mrs. Scott, "she didn't tell us. Of course after a little while the car came out, and we found out what it was."[50]

The last days of May, 1896, saw the quadricycle almost completed. Ford and Bishop were working every night.[51] "We often wondered when Henry Ford slept," remarked Charles T. Bush of the Strelinger company, "because he was putting in long hours working [at the Edison plant] and when he went home at night he was always experimenting or reading."[52] Clara worried about his loss of sleep, but did not let him guess that she feared that his efforts might culminate in a breakdown. For the last forty-eight hours before the vehicle was ready he hardly slept at all. Finally, early on the morning of June 4—between 2 and 4 A.M.—the task was finished, and the builder was ready to take his car out for a trial run.*

At this moment, however, he discovered a fact almost as disconcerting as Robinson Crusoe's realization that he had built his boat too far from the shore to permit its being launched. For while the machine was in the shed, now that it was finished it was too big to go through the door! Faced with this unexpected situation, Ford did not hesitate; he seized an ax and knocked down a sufficient part of the brick wall to permit his first car to emerge.[53] Mrs. Ford, who had sat up on this as on many other nights, came out with an umbrella, for it was raining.

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Jim Bishop was on hand with his bicycle, ready to ride ahead of the quadricycle and warn any drivers of horse-drawn vehicles of its coming—if indeed any other vehicles were met with at such an early hour—and to be at hand in case of accident. Henry put the clutch lever in neutral and spun the flywheel. When the motor came to life, he climbed to the bicycle seat, seized the steering rod, put the car in low, and started off. The quadricycle bumped slowly along the cobblestones of the alley and into the street beyond, with Bishop pedalling ahead of it. Ford steered it down Grand River Avenue to Washington Boulevard, master at last of a horseless vehicle moving under its own power. Then suddenly the car stopped.

Ford called to Bishop. The two discovered that a spring actuating one of the "ignitors" had failed. They went to the nearby Edison plant and got a new one. Meanwhile, some guests from the old Cadillac Hotel had gathered about the little car and "wondered what kind of an infernal machine this thing was, and who was crazy enough to spend a lot of time and money on such a contraption." Ford and Bishop, putting in the new spring, started the car. They decided it was operating well, and drove back to 58 Bagley, leaving an amazed knot of spectators behind them, and on arrival "both went off to bed for a few winks of sleep." Clara then served breakfast and the two men reported for work as usual.[54]

Ford was exultant. He had made only a short run, but it crowned his years of planning and his recent months of night work. He knew that the little machine would go farther the next time.

One fact he apparently did not know, nor did his friend Charles B. King. In the preceding November George B. Selden of Rochester, New York, had finally obtained his long-delayed patent for a "road-carriage." In time both Detroiters, and Ford in particular, would be made sharply aware of this fact, for Selden was to claim that his patent covered all gasoline-driven vehicles developed since 1879, and manufactured after the issue of the patent. He would soon take steps to enforce that contention.

5.

The initial run of the little car was not reported in the Detroit papers, and Ford was satisfied to be unnoticed, for he was not yet ready for a public demonstration. Indeed, his immediate concern was to repair

the break in the shed which he had made in order to get the car out. He arranged with two bricklayers at the Edison plant to restore the wall and the door to their original condition.[55] They had hardly begun work when the owner of the house, Wreford, appeared to collect the June rent.[56] When he saw the broken wall he became angry and excited. Ford tried to quiet him, explaining that everything would be restored exactly as it had been, but Wreford kept demanding, "What did you do it for?"

"I had to get my car out to see if it would run," Ford replied.

Wreford forgot his anger.

"You ran it?"

"Yes, sir."

"Let me see it."

Ford showed him the car. The landlord forgot about the wall for a few minutes, then suddenly remembered it.

"Say!" he exclaimed. "If these fellows put the wall back up, how are you going to get your car out again? I've got an idea. Tell those bricklayers to leave that opening and then you can put in swinging doors. That will let you in and out."

Thus perhaps the first garage door in the United States was planned. When years later Ford restored the little shop as an exhibit in Greenfield Village the right-hand door was still wider than the other.[57]

It was long assumed that the first car made by Ford remained, except for the addition of a seat and two water-jackets, much the same as it was when taken out for its initial run. This was not the fact. Evidence recently uncovered shows that the quadricycle was practically rebuilt in the months following that event.

David M. Bell, an American of Scottish birth (1864), had worked in Detroit at the carriage trade and at the Pullman shop in the city, but in July, 1896, found himself out of employment. He was told that a mechanic was wanted at the Edison company, where he should report to a man named Ford. Bell sought out the chief engineer, and told him that he wanted a job as a blacksmith.

"What kind of a blacksmith are you?" Ford asked him.

Bell explained that although he had been working for the Pullman Car Company, he was really a carriage blacksmith.

"Oh, a carriage blacksmith," echoed Ford. He eyed the applicant a moment and then remarked crisply: "You come to work." Bell was

really an answer to a prayer. Ford had many changes to make in his car, and in Bell found exactly the workman he needed.

He soon took the new employee down into the basement shop next door to the Edison building. There Bell saw the quadricycle, which Ford had brought from 58 Bagley. As originally constructed, nearly all the vehicle (apart from motor, axles, wheels, and steering rod) was of wood. "There were no metal parts in it," Bell recalled in 1953. Ford explained that he wanted new and sturdier wheels, a seat with metal railing, metal elements in the undercarriage, particularly for the drive, and a new all-metal steering rod and mechanism. The two men rigged up a forge and Bell was busy for weeks, doubtless mostly at night and on weekends. He made a device for shaping the metal wheel spokes and under Ford's direction fashioned the other parts for the front wheels. (The smaller rear wheels seem to have been left unchanged.) He substituted iron pipe for the mechanical elements beneath the body, and made a much improved steering mechanism. After Bell had taken measurements Ford returned the car to Bagley Avenue, took the various parts as Bell fashioned them, and rebuilt the car himself, doubtless with Huff's and Bishop's aid. Bell noticed that Ford did little work himself. "I never saw Mr. Ford make anything. He was always doing the directing." In Bishop, Huff, Cato, and Bell he had at least four highly capable workers to carry out his ideas and supply certain improvements of their own.[58]

The car was now greatly strengthened, and Ford could carry a passenger on the seat beside him. He soon began to push out of the city with the quadricycle. Nettie Bryant Scott saw it at Greenfield, and always thought that this run to Clara's old home was the first extended trip made.[59] Margaret Ford Ruddiman remembered its arrival at the Ford farm in Springwells-Dearborn, and has painted a vivid picture of the occasion:

> My first sight of the little car was as it came along what is now Ford Road. The wheels on one side were high in the center of the road. Henry had built the car in such a way that the distance between the wheels was less than that of wagons and carriages so drove in this way on a road which had a rut. Clara and Edsel were on the front seat with him and all of them were sitting on the slanted seat. I remember Edsel was a very small boy in dresses at this time and he was held tightly by his mother on her lap. . . . I well remember the peculiar sensation of what seemed to be a "great speed" and the sense of

> bewilderment I felt when I first rode in this carriage which moved without a horse. . . . After I had ridden in the car I wondered more than ever at the cool confidence and nerve which Clara displayed in trusting herself and Edsel to Henry's little car for the first ride into the country.[60]

William Ford would not take a ride that first day. "He examined the machine, listened to Henry's explanations, but wouldn't get into the car. Father was a conservative farmer. . . . He saw no reason why he should risk his life at that time for a brief thrill from being propelled over the road in a carriage without horses."

Although Mrs. Ruddiman did not recall Charles B. King's presence, King has intimated that he was the passenger who accompanied Ford on the first trip to the farm:

> I remember the day Henry Ford and I drove out to his father's farm to show off Henry's new quadricycle. Henry was as proud as could be when we swung through the farm gates. His father was a serious old fellow, a deacon and a justice of the peace and so on, and he came out of the house and just stood and stared at us. Some of the neighbors came by and stared too. I could see that old Mr. Ford was ashamed of a grown-up man like Henry fussing over a little thing like a quadricycle. We'd gone and humiliated him in front of his friends. Henry stood it as long as he could, then he turned to me and said, in a heartbroken way, "Come on, Charlie, let's you and me get out of here."[61]

Trips to Greenfield and Dearborn seem to have been only a few of those that the little car made. They convinced Ford that he needed a cooling system, for the motor heated up and bits of solder dropped from it. He brazed water-jackets around the cylinders and supplied a tank to which the water could return to be cooled. Meanwhile, he drove to Belle Isle and about town. He asserted later that hundreds of people in Detroit must have seen him with the car.[62] On one occasion, writes W. A. Simonds, Henry and Clara were spinning along Grand Boulevard at a point where a slight uphill grade gave them anxiety. A boy on a bicycle just ahead of them, even more worried as to what the strange carriage would do, fell off and rolled under the wheels. "Both Mr. and Mrs. Ford scrambled out to see whether he had been hurt—as luckily he hadn't—and the world's first automobile accident ended without a casualty."* Jim Bishop usually preceded

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* Simonds, *Henry Ford*, 54. It was of course not the first accident. Aside from some in Europe, which certainly dated back to the 1880's, Frank Duryea on November 2, and Elwood Haynes on November 28, 1895, both disabled their cars trying to avoid collisions.

the car on a bicycle and saw that all horses were firmly held by their drivers.

Undoubtedly the car frightened a number of horses, and caused protests. Fortunately the man about to become mayor, William C. Maybury, was an old family friend. He came to the shop to see the car[63]—a visit which would flower into an active interest in its inventor several years later. When elected, Maybury stood ready to give his younger friend a blessing. "I had to get a special permit from the mayor," said Ford himself in 1923, "and thus for a time enjoyed the distinction of being the only licensed chauffeur in America."[64] Simonds says it was only a verbal permit, but at any rate it pleased the builder.

He enjoyed the sensation the machine made. Sometimes he would leave it by the road in Belle Isle Park, station himself behind bushes, and listen to the comments of the curious crowds that gathered. Curiosity also brought its annoyances. "If I stopped my machine anywhere," Ford himself later recalled, "a crowd was around it before I could start up again. If I left it alone for even a minute some inquisitive person always tried to run it. Finally, I had to carry a chain and chain it to a lamp post whenever I left it anywhere."[65] Ford occasionally offered rides to friends and of course to such associates as Bishop, Huff, King, and Barthel. One acquaintance, E. G. Graham, has described his sensations as he drove with Ford one day on Woodward Avenue:

> A man ran across the street to the west in front of us, and Henry deliberately clanged the gong and chased him. . . . I recollect there was quite a cloud of smoke well in the air behind us, and we hadn't gone far before there were twenty-five to fifty bicyclists following us. We circled around—I do not remember where—until finally we reached Lafayette Street, going west, and when we got fairly close to Fourth Street Mr. Ford instructed me when we turned the corner to jump out and run and open the door of the stable so that the car could be driven in before the crowd of bicyclists overtook us. This was done, and Mr. Ford had just snapped the padlock in the hasp when around the corner they came and one of them said, "Mister, can you tell us where that horseless carriage went?" Henry replied, "Yes, right up that alley," and away they went up the alley to the east. Mr. Ford gave one of his humorous chuckles, and we walked back to the Edison station.[66]

A ride in the quadricycle was definitely an adventure, spiced with its builder's love for a joke.

6.

Meanwhile other pioneers were perfecting their cars, and those who had passed the first stages of experimentation were writing by various acts the still faltering history of the automobile.

The leader was Frank Duryea. He was not acknowledged as such by his older brother Charles, who established himself as the chief stockholder in the Duryea Motor Wagon Company. Frank felt that what he had done entitled him to share equally with his brother, but received only half as large an interest—"I thought, and still think, it was unreasonable." He remained the man responsible for design, and while Charles took the old car to Peoria (whence it found its way to Detroit), Frank designed a better model. During 1896 a total of thirteen machines were built. The first was exhibited at the Mechanics Fair Building in Boston, February 20–24, 1896, and there the younger Duryea believed he sold it to George H. Morrill, Jr., of Norwood, Massachusetts.[67] This seems to have been the first sale of an American-built car in the United States.*

On May 30, 1896, the Cosmopolitan Race, sponsored by John Brisben Walker, owner of the *Cosmopolitan Magazine,* was held. The course was from City Hall in New York to Ardsley-on-the-Hudson and return. Four Duryea cars were entered, and three actually competed. As their only competitor was a Benz, which gave up midway, the car driven by Frank Duryea won the prize of $3000, while another Duryea driven by Charles came in second.[68] It is significant that none of the pioneers who were now working on cars or had produced them—Haynes, King, Olds and possibly Winton—as yet had machines in which they felt full confidence, or, if they did (as was possibly the fact with Haynes and Apperson), had the money and time to gamble on winning.

Frank Duryea now proceeded to re-design his car, using a generator instead of batteries for his ignition, lessening the weight, and making other improvements. Taking this model to Europe for the London-to-Brighton Race, November 14, 1896, he defeated the Panhard & Levassor machine which had won the most recent European contest!

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* Other cars were sold in [illegible] ng's car [illegible] More- [illegible] Frank

This was amazing, for although European models had been operating a decade, an American inventor whose first car had appeared only a little more than three years earlier had built one apparently superior to anything the French or Germans had produced. Harry Lawson, who drove the Panhard, was then organizing a British Motor Syndicate, and seems to have been convinced that the Duryeas had a highly valuable property. He offered £40,000, part to be paid in stock, for the British (and probably the European—Duryea does not say) rights. Two directors of the Duryea Motor Wagon Company then in England consulted with Frank Duryea and decided to delay acceptance in the hope of a better offer. Lawson soon withdrew his proposal.[69]

Had the offer been taken, it might have had a far-reaching effect upon the growth of the industry in the United States, enhancing American prestige, stimulating inventors and capital, and above all, providing the Duryea company with resources for improving their product. Unfortunately, no sale of rights was made in Europe, although a Belgian firm was licensed; and meanwhile at home the Company did not improve its position, partly because of internal difficulties. Frank and Charles Duryea left it in 1898. Frank, after a brief success with the Stevens-Duryea (1903–1915), then retired because of poor health.[70] His failure, like that of King, is somewhat puzzling. In 1896 his car was further advanced in design and performance than any that would appear in the United States for six years. Like King, he probably lacked capital, and possibly also was too much the ingenious inventor and not enough the large-scale engineer and manufacturer.

The Haynes-Apperson Company, formed in 1895, had meanwhile made struggling progress. The Apperson shop was well managed, Haynes had a sound background in metallurgy and mechanics, and already in 1896 the organization was producing machines to order. It slowly achieved momentum during the next few years. By 1898 its cars had taken definite form and production had increased, though under rather crude conditions. When in 1899 it sent an inquiry to the Hyatt Roller Bearing Company, the sales manager for that young company went to Kokomo and made arrangements to do business with them, reporting to his partner Alfred P. Sloan, Jr., that the cars "were made in a dirty little factory about as primitive as our own place. Most of the work was being done on a dirt floor."[71]

Ransom E. Olds, who had pioneered in the development of steam-

propelled vehicles, had a successful gasoline-propelled model in operation by 1896, although his subsequent statement that perhaps he had sold a model as early as 1895 was probably wishful thinking.* Yet he was now progressing in his development of the car that would become the Oldsmobile and would break ground in quantity production of cars.

In Cleveland the energetic Scottish-born manufacturer, Alexander Winton, was about to put a car on the street and move quickly from experimenter to quantity producer. He had first experimented with a motor bicycle, which apparently ran. But he discovered the weaknesses of existing motors and built one of his own. He then made an arrangement with the Winton Cycle Company to build a car for him at his own expense. The resulting carriage was powered by a two-cylinder motor of five-inch bore, using electrical ignition. It was a vertical type, with a shaft length-wise of the wagon and a bevel-gear drive to the live rear axle. The wire-spoke suspension wheels carried four-inch single-tube tires. The machine weighed almost 2000 pounds.

It took the road in September, 1896, carrying five passengers on its first run from the Winton shops to the Cleveland public square and back—almost five miles. It made many trips during the winter of 1896–97, and the Winton Motor Carriage Company was organized in March, 1897, with a capitalization of $200,000. After completing six omnibuses which were quite operable, but never paid for because of public protests and damage suits, the Company developed a 1400-pound phaeton. It was remarkably successful, and a sale was made on March 24, 1898, which marked the beginning of continuing business.[12] Winton long hailed it as the first American sale of a gasoline car, and although that honor clearly belongs to the Duryea Motor Wagon Company, Winton's sale does seem to have been one of the first marking a steady process of quantity manufacture.

Despite such accomplishments, these were difficult days for automotive pioneers. The Duryea triumph in England, carriages being made by Olds and by Haynes and Apperson, the beginnings by Win-

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* Selden Case Record, XVIII, 914, 917. In this suit a number of the early builders of automobiles came close to engaging in a pre-dating contest as to their achievements. Ford, Haynes, Olds, Charles [illegible] Barnes ("The Romance of Our [illegible] ng regularly thro[illegible] st, saw him and [illegible] or Vehicle Company.

ton, and the mushroom activities of a number of hopeful automotive enthusiasts all were pioneering accomplishments. Most of those who were striving to improve their rude horseless carriages could really be exultant in print only. There they could even find readers who were friendly and credulous.

"A pleasing prospect it is," announced *Horseless Age* in its first issue, "that rises before us in contemplating this array of horseless vehicles! From the gradual displacement of the horse in business and pleasure, will come economy of time and practical money-saving. In cities and towns the noise and clatter of the streets will be reduced, a priceless boon to the tired nerves of this overwrought generation. Then there is the humanitarian aspect of the case. To spare the obedient beast, that since the dawn of history has been man's drudge . . . will be a downright mercy. On sanitary grounds too the banishing of horses from our city streets will be a blessing. Streets will be cleaner, jams and blockades less likely to occur, and accidents less frequent, for the horse is not so manageable as a mechanical vehicle."[73]

Prophets of 1896 could not of course foresee the double parking and week-end accident tolls of the 1950's. They had logic on their side, and experience was still unborn! "We had to talk like that in those days," said Charles B. King in retrospect. "We weren't any too sure of putting horseless vehicles over. People didn't like the notion."[74] No one knew this at the time better than King. He had produced a motor wagon that ran, and on August 16, 1896, it was again noted by the *Free Press* as representing Detroit in an activity that was "now coming rapidly into favor."[75] But into whose favor? Not that of many businessmen, surely. "This art is at present in a crude state," King wrote with rueful realism as treasurer of the American Motor League in an open letter to John Brisben Walker for the March, 1896, *Horseless Age*, "and is mainly in the hands of the inventor, who has not yet been encouraged by capital."[76] Half a year later he could perceive that his words had been crushingly true. He had sold his chassis—to another "inventor." He had sold his two-cycle, two-cylinder motor—to an experimenter, Professor W. H. Pickering of Harvard. He had redesigned the Duryea motor—and sold a few models—to still another of his kind.[77] He had vainly sought support in organizing a company to manufacture his carriage. Money was to be made much more easily

propelled vehicles, had a successful gasoline-propelled model in operation by 1896, although his subsequent statement that perhaps he had sold a model as early as 1895 was probably wishful thinking.* Yet he was now progressing in his development of the car that would become the Oldsmobile and would break ground in quantity production of cars.

In Cleveland the energetic Scottish-born manufacturer, Alexander Winton, was about to put a car on the street and move quickly from experimenter to quantity producer. He had first experimented with a motor bicycle, which apparently ran. But he discovered the weaknesses of existing motors and built one of his own. He then made an arrangement with the Winton Cycle Company to build a car for him at his own expense. The resulting carriage was powered by a two-cylinder motor of five-inch bore, using electrical ignition. It was a vertical type, with a shaft length-wise of the wagon and a bevel-gear drive to the live rear axle. The wire-spoke suspension wheels carried four-inch single-tube tires. The machine weighed almost 2000 pounds.

It took the road in September, 1896, carrying five passengers on its first run from the Winton shops to the Cleveland public square and back—almost five miles. It made many trips during the winter of 1896–97, and the Winton Motor Carriage Company was organized in March, 1897, with a capitalization of $200,000. After completing six omnibuses which were quite operable, but never paid for because of public protests and damage suits, the Company developed a 1400-pound phaeton. It was remarkably successful, and a sale was made on March 24, 1898, which marked the beginning of continuing business.[72] Winton long hailed it as the first American sale of a gasoline car, and although that honor clearly belongs to the Duryea Motor Wagon Company, Winton's sale does seem to have been one of the first marking a steady process of quantity manufacture.

Despite such accomplishments, these were difficult days for automotive pioneers. The Duryea triumph in England, carriages being made by Olds and by Haynes and Apperson, the beginnings by Win-

* Seld[illegible] auto-
mobiles ca[illegible] ies,
Olds, Cha[illegible] Ro-
mance of [illegible] ing
regularly [illegible] nts
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Vehicle Company.

York, Charles L. Edgar of Boston, and the great Thomas Alva Edison himself, then still in his forties. At the culminating banquet in the Oriental Hotel on Manhattan Beach, L. I., Ford talked with the inventor.

Conversation at the end of the banquet had turned to electric carriages, when Alex Dow, Ford's boss and the head of the Michigan group, said to Edison: "There's a young fellow who's made a gas car." Commenting later on the occasion, W. J. Cameron, who doubtless conveyed Ford's impression, remarked: "It was a sort of joke. Here was a man working for an electrical company and fooling with an engine that wasn't going to use electrical energy."[82] Dow, who saw no future in the gasoline vehicle, perhaps hoped that a little friendly derision might cure his chief engineer of a foolish obsession. But when he told of seeing Ford operate the car, the talk took a somewhat different turn than he expected. The convention delegates were astonished to see a man who had built a workable horseless carriage, and queried him about it. Edison, too, showed interest, and soon Henry Ford found himself seated next to the Menlo Park wizard, who asked him some pertinent questions, particularly about ignition and piston action. On the back of a menu the engineer sketched as he explained. Finally Edison brought a fist down; "he thumped the table," Cameron quoted Ford, "so that the dishes around him jumped."

"Young man," he pronounced, "that's the thing! You have it—the self-contained unit carrying its own fuel with it! Keep at it!"[illegible]

The event gave Henry Ford fresh inspiration. He would doubtless have persisted in any case, but now he was listening to the most renowned inventor in the world, who endorsed his little car with unmistakable emphasis. Edison's verdict confirmed his faith and sent him into action. On his return he began at once to plan a new model, for he had already perceived many ways in which the quadricycle could be improved. It was not long before he sold that carriage for $200 to Charles Ainsley of Detroit, and began to build a second machine. "That was my first sale," remarked Ford years later. "I had built the car not to sell but to experiment with. I wanted to start another car. Ainsley wanted to buy. I could use the money and we had no trouble in agreeing on a price."[84]

It is only justice to the first of all Ford cars to report that it gave extraordinarily good service to Ainsley and to a later owner. A letter

from this second purchaser, A. W. Hall, a bicycle dealer, to Henry Ford in April, 1899, offers a glowing account of the quadricycle. "You will be surprised," reported Hall, "when I tell you that the little carriage is still doing its usual duty. I disposed of it this spring and the little rig was still in fair shape after all the banging around that it has had and I guess you know that was considerable; I ran it almost two years as you know and about the only trouble I had was that one tire and the springs on the sparkers working loose, but you know how they were fastened and there was nothing to prevent their doing so, until I put on a binding bolt and after that I never had any more trouble with it; but I say take it all through and a rig built as you did that one just for an experiment and have it run as successfully as it has and with so little trouble, I think if you make the one you spoke of to me about last summer a year ago it ought to be a corker; you know I have the Horseless Carriage fever and consequently if you are still in it I would like to have you call around to the store and see me." Hall explained that he wanted to enter the motor carriage business. In Chicago the previous autumn he had looked over "the Horseless rigs" and now reported that "among them all I did not see one I would of rather had than that little rig for when it comes to downright simplicity they were not in it."[85]

No encomium could have been more ardent. The first Ford car had delighted its user, who wanted to be a customer again. Henry was evidently pleased, for he kept the letter. He had followed the path to what he hoped would be a commercially successful vehicle; it had not been an easy road, but it led toward a brighter future.

IX

TIME OF EXPERIMENT

When Henry Ford sold his first car to Charles Ainsley and turned to building a second, he viewed the projected machine only as a necessary step toward a more important objective. "It was not at all my idea to make cars in any such petty fashion," he said later. "I was looking ahead to production." That is, he had resolved to manufacture cars in quantity. "But before that could come," he pointed out, "I had to have something to produce."[1]

For a while he worked in the little shop back of the Bagley Avenue residence, and with Bell in his basement shop next to the Edison plant. He had experienced many shortcomings in the quadricycle. While its lightness was not a fault, for he still wanted a light car,[2] he doubtless saw that his first machine was too small and unsubstantial. He aimed at a sturdier chassis with machine elements enclosed, and at sturdier wheels; he was also dissatisfied with his mixing valve, and one of his first objectives was the development of a good carburetor. He meant to design a more efficient engine and to better the arrangement of the machinery in the car. If he did not at once perceive that his transmission, with its complex of belts and noisy chains, was faulty, he soon realized this fact and began to ponder something simpler, stronger, quieter, and more dependable.

When Henry Ford attended the convention of Edison companies in New York he probably examined a Benz, which he said later he saw at Macy's. "It had no features that seemed worth while," he recalled.[3] Doubtless he also got what information he could from such magazines as *Horseless Age* and from his discussions with Charles B. King and others. In this fashion he may have picked up significant ideas. What he learned he integrated with his own general knowledge and the discoveries he made in the course of experimentation.

In developing his second car, an expensive enterprise, Henry for a time financed his own work, buying materials for preliminary experiments from his salary; continuing at the Edison plant by day, and working on the machine after hours. However, he soon found someone who was willing to help him. This was the family friend and new mayor of Detroit, William C. Maybury, who after visiting the shop behind the Bagley Avenue house, had in his official capacity given Henry a "license." We may assume that Maybury rode in the first car and discussed with Ford the next step. His interest had reached a practical point early in January, 1897, when he wrote to A. A. Robinson of the Detroit Motor Company, 1343–1355 Cass Avenue, asking him to lend Ford a lathe. Robinson complied, and also lent or sold Ford other materials, for on the back of the letter which survives, are listed "1 lathe, 1 counter Shaft, 1 lath chuck, 1 drill chuck, 12 gear wheels, 1 lathe dog, 2 chuck wrench," with the acknowledgment, "Received same Jan. 11, 1897, Henry Ford."[4]

Such materials were doubtless used both at the little shop next to the Edison plant, where not only Bell but Bishop, Cato, and Huff assisted the inventor, and at Bagley Avenue. Ford was permitted to store the first car in Julien's part of the shed there while he worked on the new one.[5] By June, however, the Fords had moved to East Alexandrine Avenue.[6] Apparently Henry was giving his attention chiefly to the motor, and seeking other backers besides Maybury. A letter written to him by a Will Hurlbut on February 7, 1897, suggests this possibility.* Ford and his helpers were busy with the new car in 1897, evidence of their activity appearing in the inventor's financial records, which contain bills from Strelinger's for a wrench and other small parts, and from Whitehead & Lewis (Detroit Metal & Heating Works), and from S. Harvey's Sons Manufacturing Company (steam, gas, and plumbing goods). Nipples, locknuts, brass bushings, unions, ells, flanges, plugs, pipe, and brass castings are itemized. The ensuing year saw such purchases continue, with bills for collars, gears, foundry work, and electrical supplies.[7]

The presumption is that Ford received financial aid from Maybury in 1897; he certainly was working closely with the Mayor in 1898 and getting some money from him. Maybury discussed the enterprise that

* This brief, rather vague letter shows that Hurlbut and his father were interested in Ford's engines, and were arranging to come and inspect a new one.

spring with Ellery I. Garfield, who was associated with the Fort Wayne Electrical Corporation of Fort Wayne, Indiana—a company with numerous branches which installed electric lighting systems and manufactured or retailed generators, motors, transformers, and other equipment. Garfield, becoming interested, talked with Ford at least as early as May, and considered helping him finance his work. What he did and felt in the earlier stages of his interest is indicated in a letter he wrote Maybury on August 1, 1898:

> I am very much pleased [runs the body of his comment] to note the confidence you have in Mr. Ford, and also Mr. Ford's confidence in himself. I have had much more faith in Mr. Ford since the last time I talked with him, about the first of June [there had thus been earlier conferences], than I had before. I believe he has faith in himself and that is a great deal. If he has the best thing there is on the market, and it will go out on the street and stay out, with the exception of ordinary repairs, which any machine will need, he has a good thing. With all the failures there have been in experimenting with gasoline, I still think it would be a very good idea to examine into the others and compare them with Mr. Ford's, and see wherein his excells, and to what extent. I believe it would be money well invested. It might save us a heap of money hereafter, or it might give us such faith and confidence that we should go ahead and push the business and make ten times as much as what it would cost us.[8]

The letter shows that Garfield, while cautious, was more or less committed, and apparently he soon made such investigations as satisfied him. It would not have been easy, of course, to find other experimenters who could make a better showing than Ford, for Olds at Lansing was still in the same experimental stage, and Haynes-Apperson at Kokomo were also fumbling. Winton at Cleveland was just swinging into production; Frank Duryea, who had a definitely better machine, was in the East.

The evidence of Garfield's satisfaction appears in a draft contract dated "1898." Under this three-page, unsigned agreement Garfield, Maybury, E. A. Leonard, and Benjamin R. Hoyt were each to advance $500 to further Ford's experimental work on a "motorwagon." All patents taken out in connection with this vehicle were to belong jointly to the five. "It is mutually understood," continued the text, "that should a corporation be formed to manufacture the inventions of said Ford, Ford's employment on a fair compensation by said company shall

enter into any agreement made." In return for financial help, Ford was "to continue as rapidly as possible the development of his inventions, and to use due diligence in presenting all claims for patents," while he engaged not to "sell or transfer any right or invention, or construct wagons, or any part thereof, for any other person or persons in contravention of this contract."[9]

The four backers had thus come to the point of preparing a legal instrument. Ford had at this time at least one patent, for Maybury wrote him on August 8, announcing that Garfield was coming to Detroit, and adding, "I paid this morning the final fee in the case of the patent we obtained on the Carburetor."[10] Although Ford now received some kind of financial aid, no evidence exists that this was given under the contract; the probability is that it came from some of the backers individually.

Ford may have tested his "wagon" in a rudimentary form in the fall of 1898. *Horseless Age* for November of that year, in a column of news headed "Minor Mention," remarks that "Henry Ford, of Detroit, Mich., chief engineer of the Edison Electric Light Co., of that city, has built a number of gasolene vehicles which are said to have been successfully operated. He is reported to be financially supported by several prominent men of the city, who intend to manufacture the Ford vehicles. From Mr. Ford himself no information can be gleaned regarding his vehicles or his plans for their manufacture."[11] This note indicates not only that the inventor was getting the financial support he had hoped for, but that his new motor may have been tested in a chassis of some kind.

2.

By June or July of 1899 he had produced an operable car, which was described in the Detroit *Journal* of July 29 under the headline, "Ford's Automobile Has New Features and is a Novel Machine." Four pictures accompanied the article: one of "The French Automobile, Which Is to Race with the Winton Machine," another of "Winton's American Machine," still another of "First Ford Machine [really the second, of course] Completed, Made in Detroit," and a fourth of "Working Gear of the Ford Machine."

Ford is identified in this account as "a mechanical engineer and superintendent of that department of the Edison lighting station." The

overall appearance of the vehicle he had produced is not described, but the illustration shows it to have been a two-passenger car of greater size and durability than the quadricycle, with bigger wheels and tires, better lines, and in general a more finished look, the machine elements being all enclosed. Maybury's support is mentioned. "He explained his ideas to William C. Maybury. The mayor saw that Ford was working along promising lines and he encouraged the inventor and with E. A. Leonard supplied the needful cash for the experiments."

The reporter emphasizes the motor, and particularly the carburetor —"a sort of valve, or circular trap, that works automatically, and at each movement shoots just enough gasoline into the cylinder to give the charge of [sic] the engine. This is a new idea [a misstatement, of course] and once this part of the machine is started the gas is lighted by an electric spark and it works along automatically without watching."

The reporter, evidently echoing Ford, extols the lightness of the car, saying that it avoided "the extreme of heaviness in construction" characteristic of most European automobiles. "He had the points of the original American machine, the type rather, as shown in the Winton to help him." This statement indicates that Ford had mentioned the Winton machine, now famous because of its performance on May 30, 1897, when Winton set a record for the mile.[12] But the Winton, continues the article, was "not a perfect machine." It too was unnecessarily heavy, and used a chain and sprocket for transmission, while the new Ford employed one of the gear type. "He so placed the driving power of the motor so as to act directly on the rear axle of the vehicle, accomplishing three purposes. He swept out the chain, gave extra power by applying it direct, and then was able to box in the whole machinery, getting rid of dust, which on country roads is apt to prove very annoying." Ford had at least two forward speeds, a neutral position (this is specifically noted), and doubtless a reverse, although that is not mentioned.[13]

The reporter describes how he was given a ride in the car:

> Taking a seat in the carriage, Ford grabbed the lever at the righthand side of the machine and after pushing it as far forward as possible, jerked it back rapidly. The wagon [was] jolted slightly by the motion and something could be heard under the carriage. A little movement of the lever and the wagon started forward. It was in Ford's back yard and he made for the

gate to go out into the alley. It would not have been a good place even to drive [with a horse-drawn carriage presumably]. To ride over planks and the like in a wagon that was mighty uncertain was no pleasing outlook and the companion of Mr. Ford suggested that he would just as soon walk. He also hinted that if riding was desirable some nice paved street was the thing.

Ford gave the machine a couple of extra licks of speed as he straightened away in the alley. The descent from the alley to the street, John R., just north of Harper hospital, looked dangerous, especially as the thing might fail to turn and the curbstone on the other side was wide and firm. Ford let it go and did not even attempt to make a turn until he was very near the curb. Then he threw the lever over to one side a little and the wagon turned as easily as possible. There was no odor of gasoline after the yard was left. There was no sound about the machinery underneath while the vehicle was moving, nor was there any jolting.

When the vehicle stopped, however, the noise of the machinery was very plainly heard, and would be annoying if long continued. Mr. Ford says that this is a minor defect, and is largely caused by the fact that the boxes and machinery make a sounding board.

The weight of the car was given as 875 pounds, about 175 more than that of the quadricycle after its water tank, cylinder jackets, brakes, and other items had been added to the original 500 pounds. But Ford hoped for an ultimate weight of only 800. He had "specially heavy pneumatic tires" for the wheels, which were spoked like those of a bicycle, but apparently larger and sturdier. Ball bearings were used, although we do not know in just what parts of the car.

Apparently some time before this description appeared, Ford had talked with a wealthy lumber merchant in Detroit, William H. Murphy. Eight years older than Ford, Murphy had inherited his father's thriving business and had expanded it. He had long been interested in horseless vehicles. Learning of this, Ford—evidently in May or June, 1899—had obtained an interview, and had told the prosperous business man that he thought he had developed a successful motor car.

"Well, Mr. Ford," Murphy said, in effect, "if you can drive me from my home at Putnam and Woodward out Grand River Avenue to Farmington and back home by way of Pontiac, I shall be interested in helping to form a company to manufacture your car."

Several months later, apparently in July, Ford appeared at the Murphy residence. "I am ready to take you on that ride," he announced.

Murphy accepted the offer. He kept a log of the trip, noting the

fuel consumed, the condition of the roads, and the general behavior of the car. Reaching home without accident he was abundantly satisfied. "Well," he remarked, "now we will organize a company."[14]

Doubtless Maybury and his associates knew about Murphy's interests and the test, and were more than willing to accept new capital and help form a corporation. On August 5, 1899, according to the Detroit *Journal* of that date, articles for the Detroit Automobile Company were filed with the county clerk, thus establishing the first firm in the city to manufacture motor cars. Although the corporation was capitalized at $150,000, only $15,000, representing 1500 shares, was paid in. Mayor Maybury, Garfield, Hoyt and Leonard all came in, together with Murphy, Clarence A. Black, Albert E. F. White, William C. McMillan, Frank R. Alderman, Lem Bowen, F. W. Eddy, and others. Black, White, Murphy, Alderman, Ford, Eddy and Bowen were elected directors. Ford was a stockholder, but paid no money.[15]

Meanwhile Henry Ford had been faced with the choice of staying with the Edison Company or devoting full time, as superintendent, to the Detroit Automobile Company. He was well aware of Dow's attitude. "My gas-engine experiments were no more popular with the president of the company than my first mechanical leanings were with my father," he recalled later. "It was not that my employer objected to experiments—only to experiments with a gas engine. I can still hear him say: 'Electricity, yes, that's the coming thing. But gas—no.'"[16]

Dow was a highly capable engineer and executive who on July 1, 1896, had left the managership of the city's own electric plant to join the Edison Illuminating Company.[17] In 1897 he fought to a successful conclusion a lawsuit with a factory inspector who would not enter the building at the door Dow designated and complained he had been denied admittance.[18] Dow had worked well with Ford, "trusting him entirely;"[19] but his chief engineer could see no future whatever in the electric carriage. "A road car could not run on a trolley even if trolley wires had been less expensive; no storage battery was in sight of a weight that was practical. An electrical car had of necessity to be limited in radius and to contain a large amount of motive machinery in proportion to the power exerted."[20]

Later a legend pictured this opposition of viewpoint between Dow and Ford as coming to an explosive issue; Dow gave Henry an ulti-

matum—either devote all his time to Edison or leave the Company. There seems no sound basis whatever for this version.

Dow explained later that inasmuch as the Edison Illuminating Company was making plans for expansion, he had to consider Ford's role in the enlarged organization. "I knew that he was giving a great deal of thought to the gasoline car he was trying to make," he said on one occasion,[21] and on another: "Henry even at this time had the dream of an American-made automobile to be in common use. He was making experiments at home, and occasionally at the repair bench in the Washington Avenue engine room. Like myself, he was a twenty-four-hour-employee, and he took time for his own affairs if, as and when the day's work permitted."[22] But Dow had to consider the company. His notebook shows that in the summer of 1899 he had "a talk with Henry as to what part he cared to play in some big plans that we were about to carry out." These plans would curtail or completely stop Ford's own activities with the Detroit Automobile Company. "I knew that the extensions we were about to make would so increase his duties as to take all of his time. I simply wanted Henry to know what we were planning so that he could make his plans accordingly, but there was no threat to discharge him nor any time limit set before he must decide. The talk was entirely friendly."[23]

Ford's own version is not dissimilar, if slightly sharper in tone. "The Edison Company offered me the general superintendency of the company," he recalled, "but only on condition that I would give up my gas engine and devote myself to something really useful. I had to choose between my job and my automobile. I chose the automobile, or rather I gave up the job—there was really nothing in the way of a choice. For already I knew the car was bound to be a success."[24]

He might have added that he himself had forced the crisis by developing the car and stimulating the formation of a company to manufacture it. Even had Dow given him leave to stay with Edison and promote the car on the side, Ford would still have left. "I offered him the best I then had," Dow recalled years later, "in the work upon which my heart was set. It was not good enough to hold him. He asked me to join him in his venture, not only once, but twice. We parted as good friends should part."[25] On August 15, 1899, Ford resigned from the firm he had served for eight years. The agreement to leave doubtless came some weeks earlier. Ceasing to treat his automotive work as a

hobby, he now made it his business. It was to be his business for the remainder of his life.

3.

Henry Ford was superintendent of the Detroit Automobile Company, and a small stockholder.[26] He seems to have signed over his patents to the Company and turned enthusiastically to making his first commercial model.[27] Only a few changes and it would be ready.

On leaving the Edison company the inventor tried to take with him David M. Bell, who had helped him remodel the quadricycle and had also worked on the second car.

"Dave, you'll grow with the business," he urged.

"What business?" the ingenious carriage blacksmith demanded.

He had no intention of leaving the security of the Edison company for a horseless carriage even if Ford—as he saw it—was foolish enough to do so.*

The Detroit Automobile Company signed a three-year lease on the building recently vacated by the Detroit Motor Company. "The draftsmen . . . have already taken possession of one of the upper floors under Henry Ford," announced the *Free Press* on August 19, "who will be superintendent of the works. The company expects to have the plant in operation as soon as the machinery can be gotten into place, and by October 1 it is expected to have one or two automobiles completed." Before the end of August Strelinger sold the organization a Snyder drill, a grinder, a blower, a Horton drill chuck, lathe tools, and innumerable smaller items.[28]

One of the stockholders, Frank R. Alderman, the secretary for the new company and its spokesman, radiated confidence. "We have several new devices in connection with the construction of our automobiles," he volunteered, "on which patents are now pending, which will make them as near perfect as they can be made. We have solved the problem of overcoming the bad odor by securing perfect combustion, and with our improved method of applying the power to the rear axle [not at all new to Frank Duryea or to Daimler in Europe] and of keeping all the machinery hidden from sight, we will have a fine motor carriage. We expect to have 100 to 150 men employed before the year is past. We have secured a three-year lease of the building

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* So Bell states in his *Reminiscences*.

with the privilege of purchasing the property after that time if we desire."[29]

Thus the stockholders were really enthusiasts. As if by magic they saw their dingy little shop quarters expanding into acres of machine tools and assembly floors, all their own, disgorging automobiles for a motor-mad public. The magic would work in time, even beyond their expectations, but not for them.

Still, the Detroit Automobile Company was a lively firm that fall. Ford did not produce a car for them by October 1, or even by December 1—dates which Alderman suggested[30]—but he actually had one ready early in the new year. The Detroit *Journal* announced on January 12, 1900:

FIRST AUTOMOBILE OF THE DETROIT CO.
READY TOMORROW

The vehicle took the form of a delivery wagon. This was doubtless to emphasize the practical possibilities of the machine as well as its serviceability as a pleasure car. The new and improved automobile, the *Journal* announced, would be exhibited at the first annual meeting of the Company, to be held the following day.

"The body is built like any of the better class of its kind drawn about town by horses," ran the article, "and the whole thing is so constructed as to almost wholly conceal the motive power.

"The machinery, which is to do away with the horse as a drawer of wagons about the cities, looks like a very delicate piece of work, and doubtless is so in conception, but there the delicacy seems to end, as strength is one of its chief characteristics. The whole wagon will weigh about 1200 pounds, the motor taking up about 500 of this. [Despite his passion for lightness, Ford had found more weight necessary.] This weight, while it might at first seem considerable, is really very little compared with others, one of which was recently seen doing good work about the city with something over 3000 pounds of its own weight to carry. Many of the parts are made of gun metal, this material being considered the most durable of all for gear wheels, etc. The caps and the large case for the flywheel are of aluminum, which partly accounts for the light weight."

The axles were of nickel steel, which was expensive but unusually durable, and the Company boasted that because of the materials used

and the "perfection of its manufacture," the car would be good fifteen years from the date of its completion. That the delivery wagon was only one model was shown by the statement that seven more cars "of different kinds" were under construction. As to the rate of production, by March 1 the shop would turn out ten a month, with a goal of two a day as its next objective. The price was to be $1000. A catalogue, according to the article, showed "ever[y] imaginable kind of useful and ornamental conveyance, all of which can be run by women and children"! If an owner used his car six days a week for an average of thirty-six miles a day, operation would cost him only $28 a year.

The postmaster of Detroit had agreed to use the vehicle for several days, and the *Journal* predicted that cars would soon carry the mails regularly. A final sentence emphasized the aesthetic. "The Detroit Automobile Co. claims for its machine that it will emit no odor, and that it will make less noise than the ordinary vehicle drawn by a horse."

This glowing article seems deeply impregnated with wishful thinking. If catalogues, praise, and the big vision could carry Henry Ford into commercial production at high gear, his associates were wafting him there, but the dream and the reality were still remote from each other. Alderman, Murphy, and their associates seemed now to be thinking of the car as a completed job and using it as a multiple of accomplishment. Ford, wrestling with unsolved problems, knew better. The mail test, scheduled for "next week," did not take place for more than a month. To be sure, the result was hailed as a triumph, the car making the trip in a quarter of the time required by horse and wagon. However, the shop was encountering difficulties, and such performances did not speed up regular production. Neither did the announcement that a number of "phaeton automobiles" would be ready in a short time.[31]

We can only guess at the causes for delay in the shop. One factor may have been that the "heavier parts" were being manufactured elsewhere, and sometimes arrived late.[32] Another may have been the inexperience of the men in assembling a car, and their constant discovery of shortcomings in the parts delivered by other firms, and in the car design. "You would be surprised," Alderman told a reporter in February, "at the amount of detail about an automobile." They had been delayed for weeks over a spring or a small gear. "To show the trials of the automobile builder, let me say that we lost a week simply be-

cause we found that the steering rod apparatus would bind in a certain way, on account of a little screw and a small catch. One of the screws was about one-sixteenth of an inch too long; and as there were a lot of other screws in the plate, it took us a long time to locate the trouble. It was only after we had spent about $50 that we found where the trifling hitch came."[33] It seems safe to say that if seven machines were under way early in 1900, most of them were in the planning stage.

William W. Pring, who was later to work for Ford and already knew him, was at the Olds plant in 1899, and tested that company's new cars. He recalled seeing Ford, evidently that summer, operating his own machine, and once in his "curved-dash Olds" ran a race with Henry. "I beat him. He could only go about twenty-five miles an hour." Not long after, Ford asked Pring to come and work for him.

"Well," countered the Olds employee, "have you got me something [to do] building this car?"

Ford replied: "I've got one and a half started."[34]

This seems to have been in the fall of 1899. The Detroit Automobile Company plant, as Pring recalled it, had space in the same building as the C. R. Wilson Body Works. Perhaps Alderman had rented a part of the structure to this organization. "They [Wilson] had the back part of it and Ford had the front part downstairs." The Wilson firm was making bodies for Olds. Ford's working force, as Pring recalled it, consisted of the overseer, George Abbott, the blacksmith, George Wetterich, the electrician, Arvy Wilson, and two laborers. Actually others were employed, including William Boyer, Ed (Edward S.) Huff, and John Thomas. Pring makes no mention of the men engaged in drafting, noted by the Detroit papers, among whom was Boyer.

Even before the "delivery wagon" made its mail runs, an enterprising reporter for the *News-Tribune* had taken a ride in it. His observations were reported on the front page of the second section of the paper[35] under a three-column head:

SWIFTER THAN A RACE-HORSE
IT FLEW OVER THE ICY STREETS
Thrilling Trip on the First Detroit-Made Automobile,
When Mercury Hovered About Zero.

A pen-and-ink illustration, with the caption "Showing How Easily an

Automobile May Be Steered Out of Danger," depicted a car with two occupants being swung aside from the path of a team of horses.

The reporter related how he had gone at five degrees above zero to ride in the new car "which will soon be seen in the regular service of one of the largest firms on Woodward Avenue." He commented favorably on its appearance: "Smooth-covered, box-topped, with black enamel sides, red wheels, and running gear, nothing but the absence of the proverbial horse revealed that the motive power was to come from within." From the seat, to the reporter's surprise, no machinery was visible except the brake pedal and steering levers. The engine and other running parts were "placed practically under the floor." He commented on the use of aluminum, and the lightness and compactness of the mechanical units. "There was really little or nothing to show that there was an engine aboard at all." Ford, discovering that he had no gasoline, filled the tank, which held three gallons—"enough to run the automobile 100 miles or more at the rate of a cent a mile." He assured the reporter that the running gear was sturdy, and that the machine weighed 1300 pounds "complete."

Ford then gave a few jerks at the starter, explaining that this pulled a charge into the cylinder. He pressed an electric "switch handle" and the engine came to life. "She's ready!" he announced.

"But you didn't touch a match to something or other?" asked his passenger, evidently for the benefit of the *News-Tribune's* readers.

"No necessity," answered Ford with a smile. "The ignition is by electricity. Didn't you see me touch the switch up there? That fires the gas, and the puff you heard was the explosion."

As a man opened the factory door, the machine rolled out. With "incomparable swiftness" it picked up speed and glided into the snowy, windblown streets. It didn't mind the near-zero temperature in the least. "It flew along with the very poetry of motion." Ford first took the car out on a country road, rutted and partially snow-covered, and went at about eight miles an hour "with a dream-like smoothness. There was none of the bumping common even to a street car." Then Ford warned his passenger to expect some speed.

"Hold on tight!" he counselled. "When we strike the asphalt we will have a run."

"How fast?"

"Twenty-five miles an hour."

"Hold on. I get out!"

Naturally he didn't. There was a sharp clang—clang of the car's bell as the driver warned a milk wagon he was approaching.

> The horse pricked up his ears, his eye gleamed ominously; he shivered as though about to run away. His driver applied the whip.
>
> "Ever frighten horses?" asked the visitor, wonderingly.
>
> "Depends on the horse. A low-bred, ignorant horse, yes; a high-born fellow, no. There's as much difference between horses as between dogs. Some are wise, some otherwise. The other day I was passing down in front of the Majestic building in the big crush; along came a man with a speeding cart and racer. Alderman, who was with me, told me to slack down, as there would surely be trouble. The racer came flying right by us and merely gave a side glance. He was too wise to show any emotion."

When they reached the boulevard, Ford shifted the lever and picked up speed. And, declared the reporter, he now heard a noise new in history—the noise of the automobile.

> There has always been at each decisive period in this world's history some voice, some note, that represented for the time being the prevailing power.
>
> There was a time when the supreme cry of authority was the lion's roar.
>
> Then, came the voice of man.
>
> After that, it was the crackle of fire.
>
> By and by, it was the hammering of the stone ax.
>
> Then, it was the slapping of the oars in the Roman galleys.
>
> Next it was the voice of the wind against sails.
>
> It came at last to speak with a loud report, such as announced the reign of gunpowder.
>
> The roar of dynamite was a long time later.
>
> The shriek of the steam whistle for several generations has been the compelling power of civilization.
>
> And now, finally, there was heard in the streets of Detroit the murmur of this newest and most perfect of forces, the automobile, rushing along at the rate of 25 miles an hour.
>
> What kind of a noise is it?
>
> That is difficult to set down on paper.
>
> It was not like any other sound ever heard in this world. It is not like the puff! puff! of the exhaust of gasoline in a river launch; neither is it like the cry! cry! of a working steam engine; but a long, quick, mellow gurgling sound, not harsh, not unmusical, not distressing; a note that falls with pleasure on the ear. It must be heard to be appreciated. And the sooner you hear

its newest chuck! chuck! the sooner you will be in touch with civilization's latest lisp, its newest voice.

They "rushed" along, presumably at 20 or 25 miles an hour. The reporter saw a heavily-laden brewery wagon loom up, and cried "Look out!" but the driver "turned gracefully to the right." The passenger, now really alarmed, wanted to get out, but Ford said "Nonsense!" As he dodged a pedestrian, he announced he would show how quickly his vehicle would stop. "I'll wager a race horse going a mile in 1:40 cannot be hauled up in less than one-sixteenth of a mile; we'll do it in six feet." He did. The reporter wanted to know how long it would take to learn to drive.

"Oh, depends," replied Ford. "Have you any sense about machinery?"

"Little."

"Well, in a few days, maybe in a few hours—there's little to learn. Ride a bicycle? It's the same thing."

"But," remonstrated his guest, "that puffing! Isn't she liable to blow up?"

"Nothing to blow up!"

"But we are sitting on top of three gallons of gasoline!"

"That's nothing. It's perfectly safe. There's no fire about here. And then, we're in the open air."

They passed a harness shop. "His trade is doomed!" Ford announced.

> The clanging of street car gongs mingled with the sound of the auto bell, adding a new noise to the alarms of daily life. But she slid over the earth with infinite ease; and careened in and out among trucks, delivery wagons, carriages and bicycles; and everywhere people had a welcoming smile and an expression of delight. The new "chuck! chuck!" the newest voice of civilization, sounded like rare music in their ears—a music as yet involved with the delight of absolute novelty.
>
> "The horse is doomed," said the passenger.
>
> At that moment the auto whizzed past a poor team attached to a truck.
>
> "That's the kind," said Ford. "Those horses will be driven from the land. Their troubles will soon be over."
>
> And the "chuck! chuck!" of the new voice sounded for the first time in the strange horses' ears.
>
> Meanwhile the auto had slipped like a sunbeam around the corner.

The account gives us a vivid glimpse of Ford as a demonstrator, and

of his driving habits—he was always to drive with a slap-dash confidence that later worried employees of the Ford Motor Company. It gives us some sense of familiarity with the improved model of Ford's second car. Particularly it recreates for us the wonder and exhilaration which the first passengers in such vehicles knew.

4.

The Detroit Automobile Company made a number of cars. Pring saw three and seemed to think that they were the full output in 1899-1900.[36] This appears improbable and Ford gives a different account. He stated later that he built twenty-five cars in the period from 1896 to 1903, "of which nineteen or twenty were built with the Detroit Automobile Company."[37] Testifying in the Selden Patent Case, he said that he made from twenty to twenty-five cars in the period from 1896 to 1903, all but three or four made in the period 1899-1901.[38] Ford's estimate is given some support by a statement on April 18, 1900, in *Horseless Age*, that "The Detroit Automobile Company are now getting out 12 vehicles with standard gears and interchangeable bodies."

In connection with the interviews he gave in 1952, Pring wrote for Charles T. Bush an account of how a car was put together by the Detroit Automobile Company. He had come to work there, perhaps late in 1899, perhaps early the following year. "My job," he said, "was to help assemble motors and cars and checking them mechanically." He showed a remarkable memory for detail. Indeed, his 1200 word statement recreates for us the processes involved in putting together an early American car, and indicates why production staggered along slowly, sometimes yielding only three or four machines a year.[39]

Pring described the motor as a two-cylinder, opposed type (four-cycle, of course). One feature was a marine governor which regulated the distributor and the gas control. "This corrected the missing and sluggish running condition of the motor."

The men assembled the motors on a bench. The frame of the car was then placed on wooden horses, and the motor, transmission, springs, and axles were installed. This furnished a complete chassis; wheels were then attached, and finally the body (that is, sides, seats, cushions, dash, and so on) was assembled in place. The complicated character of the work is well indicated by Pring's description of frame assembly:

> The frame assembly for these cars were [*sic*] made of angle iron. In mak-

ing up these frames we had to reinforce the corners of the cross members to sides of the frames with plates and drill and rivet them. We did this also to the cross frames of the motor supports to make it strong and also keep it in line so that it would keep the frame steady at all angles for road conditions. We also riveted front and rear spring brackets to frame to assemble front and rear springs. In assembling front and rear springs we assembled spring bolts and shackles to spring brackets on frame. Grease cups were assembled to spring bolts and shackle bolts on all springs. Rear axle was assembled to rear springs with U bolts and dowel pins and tightened down. Brake bands were assembled to rear axle wheel housing. Front axle was assembled to front springs with U bolts and tightened down. Steering knuckles were assembled to front axle on right and left side of frame. Steering post bracket was assembled on the right side of frame. Drag link was assembled to steering brackets. King pins were assembled on steering knuckles. Tie rod was assembled from right side to left to steering knuckles. Gas and spark control was assembled on steering column with brackets on spark and gas assembly. The hand controls on spark and throttle were 2 in. below steering wheel assembly.

It can be seen—remembering that motor assembly, frame or chassis assembly, and body assembly were all required—what an immense amount of detailed hand work was involved, with much alteration or repair of parts that did not fit, and much drilling, riveting, and bolting. The number of items to be separately adjusted—exhaust, muffler, tail pipes, brakes, brake rods, wheels, tires, levers, dashboard, windshield, horns, fenders, steps, and so on—seemed staggering. The marvel is that any of these elaborate early carriages got put together correctly, and, with all their bolts, rivets, screws, and other vulnerable connections, proved durable as day-in-and-day-out conveyances. In comparison with later cars, of course, they were not durable at all. And yet, placed beside Lenoir's first car or even Benz's, the 1900 Ford was clean in design, stronger in its parts, and less troublesome by far as to repairs.

Ford, keenly aware of the shortcomings of his car, was constantly seeking improvement, and according to Oliver Barthel was dissatisfied with all the models the Company produced. "He thought those [the cars of 1899-1900] were not commercially feasible. He didn't want to go ahead with that type of car."[40]

5.

As a matter of fact, Ford at this time seems to have lagged behind

a number of American builders of automobiles in some aspects of manufacture. The differences were not great in design, and not great at any particular point in assembly, since all were having abundant troubles; but some had gone further toward simplification. It is time to note their activity, for it made a complex of practice from which Ford was later to emerge, his main difficulties overcome, as one of the leaders.

At this point the bicycle again forces its way into any comprehensive account of automotive development. Its superficial but important influence on all the early inventors has already been pointed out. Not only did it give many riders a vivid conception of a free road vehicle, as Hiram Percy Maxim so graphically suggested, but it also transferred to the first automobiles something in the way of form—manifest, for example, in Benz's and Maxim's tricycles, Daimler's motorcycles, and Ford's quadricycle; in the use of the sprocket and chain for transmitting power; and in the development of a light, pneumatic-tired wheel. Of course both the steam tractor and the ordinary carriage and wagon, as previously emphasized, had also helped determine the structure and appearance of early gasoline-propelled cars.

But the influence of the bicycle from the start had been deeper than the obvious details would indicate, and as the automobile advanced that influence became still more organic. This more fundamental influence has to some extent been indicated: it affected the quality of metals employed, the standards of mechanical precision in parts manufacture, the use of particular elements like the ball-bearing and the gear, the development of tools and methods for production, and, finally, the organization of shop procedure to give relative form and coherence to the production of a machine. Of course, the automobile was a far more complex mechanism than the bicycle, but the bicycle had marked out the road along which both would progress. Now, as the 1890's advanced, the automobile leaned heavily on its fragile predecessor. One might say that a dramatic shift took place in the type of influence exerted. The superficial likeness of the automobile to the bicycle as a machine became less notable. The relationship in materials, standards, the machine tools commonly employed, and the factory processes followed became more striking.

That relationship went back to the modernizing of the bicycle which took place when in the 1890's intelligent manufacturers perceived the

necessity for making a machine at once lighter, stronger, and more efficient in utilizing the energy expended by the rider. These needs led toward improvements little short of revolutionary in metallurgy, frame design, the application of power, and the precision of parts. To achieve them, the scientific exploration of metals, the invention of new machine tools, and the organization of orderly manufacture were essential.

As to metals, we have already seen that the Pope Manufacturing Company had established a metallurgical laboratory in 1892, "the first of its kind in New England, and the first outside of the large steel mills,"[41] where the company experimented with various kinds of steels and steel-making processes. One development was the use of nickel steel for bicycle frames, suggested by Harold Eames, then a Naval engineer, later manager of the Tube Department for Pope, and finally a Vice-President of one of its companies.[42] As a result of research in metallurgy and design the weight of bicycles is said to have been reduced forty per cent by the Pope organization.[43]

But if the improved quality of metal, permitting the use of tubular instead of solid members, and of smaller and lighter parts generally, was one factor, the working of metal was quite as important, and perhaps more so. And to work metal into the forms desired and to make these forms precise and interchangeable, the bicycle-manufacturers vigorously developed American machine tool practice. "There was a time," remarked Hugh Dolnar in 1895, writing on "Bicycle Tools," "when here in America the armories at Springfield and Illion and Hartford were immeasurably in advance in tools and methods for small work; later, the sewing machine manufactories carried the art a long step beyond the armories; and now the bicycle shops [factories] take the lead in point of small-tool designing and operation." The automatic screw machine and the turret lathe were improved in the Pope and other plants, while single-purpose machine tools for making pedals, hubs, spokes, and so forth became common.[44]

In the Pope factory, hammers ranging from six to fifteen hundredweight capacity pounded out drop forgings. Tolerances reached a hitherto undreamed of fineness for vehicular work—bevel gear units were machined to 1/2000 of an inch. In the Eclipse Bicycle Company plant at Elmira, New York, many special purpose machines were used: the chain-shaver, the chain-riveter, slot-cutter, and crank profiling units. "Before attempting to turn out any number of bicycles," wrote one

observer in 1897, "a jig or form is specially made, and in this jig or form is placed whatever part of the bicycle work is being done. All pieces made in such forms will be absolutely alike and interchangeable."[45] The ball-bearing was a by-product of the "safety" bicycle, and this device, while originally made for the bicycle alone, soon developed into "a vast industry involving a large number of new tools, new machines, new processes."[46]

The machines developed by the bicycle industry were important both for its own work and—once they became known—for that of other manufacturers. So too were the factory processes which sprang up to promote efficient routinization of work. Orderly procedures were evolved, departmentalization was instituted, specialization was promoted, and the entire work of manufacture was systematized.

By 1899 the automotive industry had already been profoundly influenced by such accomplishments and practices. In many instances the effect had been indirect rather than direct. The automobile maker turned to foundries and factories for his parts—often to manufacturers who made bicycles or bicycle elements. He procured in this manner such components as tubing, gears, chains, spokes, ball-bearings and wheels. Thus he took the benefit of bicycle experience. Even in having work done by shops like Lauer's he procured the service of many tools invented or improved in bicycle factories. Great as was Leland & Faulconer's debt to the best independent machine shops, when the firm did precision work for the Pope Manufacturing Company, it doubtless profited from the acquaintance it gained with the machine tools of the bicycle industry.

It is interesting to note the specific debt of some of the chief automobile makers to the bicycle industry. In developing the Duryea and Haynes-Apperson cars the experimenters leaned heavily on general machine shop experience and services. Haynes depended upon his own researches and technical training and on the excellent Apperson facilities. Frank Duryea had been a tool and die man and seems to have used local machine shops to produce such parts as he did not make himself. The fact that Charles E. Duryea operated a bicycle firm apparently exerted little influence on the Duryea cars, although it may have affected such ideas as were contributed by Charles himself.

Nevertheless, both the Duryea and the Haynes-Apperson machines showed their indebtedness to bicycle-production practice. The Duryea

car used a tubular frame, while in advanced models the wheels and tires had a close relationship to bicycle types. Up to 1897 the chain and sprocket were a part of the transmission, and axles and gears both owed much, even though indirectly, to the researches and shop practices of the Pope Company. Quality and treatment of metal and precision of machining counted here. Little evidence exists as to the exact character of the later Haynes-Apperson machines, but the first models employed bicycle wheels and tires and ball bearings. The Duryea car also relied upon these elements: Frank Duryea states of his first successful machine (essentially the 1895 winner of the Chicago race): "The transmission shafts were mounted on ball-bearings, and the free gears ran on graphite oilless bearings so that almost no oiling was required. The live, chain-driven rear axle also ran on ball-bearings."[47] The later Haynes-Apperson cars doubtless contained many parts which in material and method of manufacture benefited from bicycle research and tools.

The Olds machine in its early stages paralleled at many points the Duryea or Haynes cars—tubular frame, chain and sprocket, ball bearings, pneumatic tire, bicycle-type wheels. Later, in 1901, the Dodge Brothers shop, equipped with standard machine tools that profited from bicycle manufacturing practice, made transmission gears for the Olds, while Leland & Faulconer produced their engines. F. L. Smith, one of the family that had backed Olds financially, and in 1901 a worker in the plant, claimed that the Olds Motor Works at that time developed the first automotive organization that produced cars in quantity.[48] Until after the fire of that year the plant had manufactured gas and gasoline engines, with marine engines a specialty.[49] However, the firm vigorously pushed its automotive activities, and in their production methods, with jigs, forms, machine tools, and an assembly process which built the car by progressive steps, they leaned to no small extent on bicycle practice.

When we come to Winton we find a bicycle manufacturer who drew on his experience both in design and manufacture; and the same is true of the Pope firm, whose cars were developed by an organization which was the last word in up-to-date production.[50] Ford owed his debt to the bicycle in much the same fashion as the others. The wheels, gears, axles, tires, and frame of the 1899-1900 machine indicated the debt, some of which lay in the machine tools and standards of the shops that turned out various parts for him.

By 1900 there were of course dozens of other cars besides the ones discussed in the last few pages. The Waverly (another car—electric—by a bicycle manufacturing firm), the Stanley (steam), Stearns, and Thomas & Matheson had appeared in 1898, the Locomobile, Baker-Electric, and Pierce-Racine in 1899, and the Packard, Peerless, Glide, Lambert, Elmore, Babcock, Jackson, Knox, and Lane in 1900.[51] Lesser firms had sprung up, promising to produce in quantity, but most of them had staggered along, or perished. All owed a debt to the bicycle.

Ford was quite abreast of the majority of these pioneers, and in some respects superior to all but a few. His motor was perhaps not yet as good as Duryea's, Olds's, or Winton's, but it was a respectable achievement, with a fair carburetor for the day, and was soon to be improved. His transmission apparently excelled that of most cars; the quality of materials he used was good. The parts of the cars were not always interchangeable—manufacture was still too much a hand job. Because of this fact and the lack of simplification, the car was not dependable. His instinctive prescription for a machine had been sound: make it light, make it sturdy, make it simple. Apparently he had thus far not achieved his second and third objectives as fully as had some of his rivals.

Indeed, several already had accomplishments to their credit that Ford could not match, or even hope to match in the near future. The Duryea machines had won races under unfavorable conditions in the United States and had beaten the field abroad. The Duryea company had a factory with something like organized production; as early as 1896 it had produced thirteen cars in a season.[52] Winton had not only set a speed record for the mile, but as early as 1897 had driven his car from Cleveland to New York.[53] Olds had a strong, well-financed company, and Charles B. King was now working for him—an indication that sound engineering was valued. The "curved-dash Olds," a one-cylinder light little machine, was being perfected in 1900; then in 1901 the Olds "assembly line" turned out 425 cars, and in 1902, 2500.[54] In the fall of 1901 Roy D. Chapin, later Secretary of Commerce under Herbert Hoover, would drive an Olds from Detroit to New York for the second Automobile Show, making the trip in seven and a half days.[55]

During the year 1900 the Detroit Automobile Company ground slowly to a stop. Probably the machine it could make was not good enough, and was too expensive. Ford explained later that the car would

not sell. Apparently he wanted to make a better one, and his stockholders vetoed the idea. "I could get no support at all toward making better cars to be sold to the public at large," he said of the 1899-1902 period.[56] The Company seems to have given up about November, 1900, when it "surrendered its charter and went out of business"; and in January, 1901, notice of its dissolution and the sale of its assets was filed in Lansing.[57] Nevertheless its record had not been a bad one. Few companies founded in this period manufactured as many cars or lasted as long.

About this time Ford seems to have turned to the idea of building a racer. "I never thought anything of racing," he remarked years later, "but the public refused to consider the automobile in any light other than a fast toy. Therefore later [that is, some time after the founding of the Detroit Automobile Company] we had to race."[58] Perhaps news of races in Europe, the publicity accorded to speed and distance records, and particularly Winton's exploits, suggested that to sell cars it was necessary to create a sensation. Winton made another trip to New York in May, 1899, and won much publicity by a challenge he issued to Charron, winner of the Paris-Bordeaux race that year, to come to the United States and meet him for any distance less than one thousand miles, each driver to put up $10,000 and the winner take all.[59] Winton finally met the Frenchman in the early summer of 1900, but not in an individual test, and not in America. Both entered the International Automobile Challenge Cup Race—Paris to Lyons—and Charron won the event. Winton did not finish. However, he lost little reputation in the United States, for he returned to win new races there, and to establish a world's record of 1:14¼ for the mile in 1901.[60]

Whatever the source of the impulse, Ford determined to build a racer and use it to achieve recognition. Perhaps the idea was W. H. Murphy's, for Murphy financed the venture.[61] Ford was soon at work on this new machine, which he hoped to make speedier and more powerful than any the world had yet seen.

X

RACING: A PRELUDE

In 1901, in his thirty-eighth year, Henry Ford was richer both in reputation and experience than he had been in 1896 when he built his quadricycle. To be sure, his first business venture had ended in failure, and he had no job beyond the experimental task of building the racer. He was tabbed by many Detroiters as an eccentric, and with the exception of Clara his own family thought he had been foolish to leave a good position with the Edison Company. But Ford, unworried by such opinions, had gained from his years of exploratory work an intensified faith in the car he would eventually produce. Much as he still had to learn about building engines and automobiles, he felt that he was now in sight of an attainable goal. The racer would be an easier task than a new commercial model, for the former, stripped to the bone, was less complicated. Then would come the machine he had long envisaged—light, strong, dependable, and low-priced.

He had a shop at Cass Avenue and Amsterdam Street, about three miles north and a little west of City Hall. For a time he may have worked there alone, or with one or two helpers. His chief assistant while he was superintendent of the Detroit Automobile Company was William Boyer, whom Oliver E. Barthel so designated, and whom Ford himself later mentioned when testifying in the Selden Patent Case; a man who had "previous experience with automobile design and construction."[1] Ford may have kept Boyer for a while after the dissolution of the Company; he perhaps kept Ed Huff, who was certainly with him a few months later, in the spring of 1901.

Ford was living and working economically. To save money, in January, he, Clara, and Edsel moved in with his father William Ford, who had come to town. Margaret Ford, who had been William's housekeeper, had recently married James Ruddiman, and Jane had taken

over her work. They had quarters either on Henry Street or at 582 West Grand Boulevard, where the Henry Fords, as Clara's diary shows, joined them on January 8, 1901. This same brief record shows that Henry worked all day on New Year's and often did not come home to supper.

While the need for economy was doubtless real, Henry was able on February 11 to lend his brother John $200 for a year. John had borrowed $600 from a bank on November 1, 1900, and apparently used the money from Henry to help discharge this debt on March 1.[2] It is not unlikely that Henry and Clara were comfortably situated financially, and that their economies were merely precautions against an uncertain future.

Part of his work seems to have been the completion of an unfinished model inherited from the Detroit Automobile Company. This machine was in use by April 25, when Clara notes that "Henry and Mr. Murphy went out with Automobile," driving "to Farmington around to Orchard Lake, on to Pontiac, back home. Started Half after 2, Back at 6." This car is again mentioned by her on April 25 and May 15. Conceivably Ford could have used it for experiments looking to his racer, which in its eventual form had not yet been started. Intensive work upon the racer seems to have begun in May. When Charles B. King that month sold his shop and designs to the Chicago Pneumatic Tool Company, Barthel was out of a job, and opened an office as a consulting engineer. According to him, Ford proposed that he work half time on the racer, and the two, with Huff and Ed Verlinden (formerly of the Lauer Shop), then pushed ahead with it.[3]

2.

The period, so crucial for Henry Ford, was also one of ferment and growth for the entire automobile industry. That activity was in fact a phantasmagoria of bold ideas, ingenious and stubborn experimentation, enthusiastic promotion, dramatic accomplishment, and weird display. From it developed the steadier era of manufacturing in which Henry Ford would emerge as a leader.

Although by 1900 at least fifty-seven American plants engaged in making motor cars, many were in an experimental state, the basic type of vehicle had not yet been determined, and it was uncertain where the chief centers for the new industry would develop.[4] This year saw

about 4000 American cars manufactured, of which steam and electric models made more than three-fourths. One respectable set of figures lists 1681 steam carriages, 1575 electrics, and only 936 gasoline cars.[5] The future center for the new activity seemed to be New England. To be sure, Olds was in Michigan, Winton operated in Cleveland, Haynes-Apperson in Kokomo, Indiana, and the new Packard plant was in Warren, Ohio. These firms, together with a number less substantial, gave the West an important position. The Middle Atlantic area was also a scene of activity. In Pennsylvania Charles Duryea was at Reading, and Autocar at Ardmore. In New York the H. H. Franklin Company was at Syracuse, and the George N. Pierce Company in Buffalo. But Massachusetts and Connecticut made the strongest showing. At Springfield in the former state Frank Duryea, having launched the first continuing American production, was engineer for the American Automobile Company. The Knox plant was situated there. The Locomobile, the Waltham, Overman, Oakman, Stanley, and Holyoke works were all in that state. In Connecticut the Pope Manufacturing Company had developed an impressive output in both electric and gasoline cars. "Our Pope Manufacturing Company led the country in 1899 in the building of motor carriages," wrote Hiram Percy Maxim years later.[6] New England produced 1191 steam cars as against 470 for all other states; 734 electrics as against 841 for the rest of the country; and 171 of the 936 gasoline models produced. It seemed to have the factories, the skilled workmen, the mechanical experience. The prospect would quickly be transformed as the West, and especially Detroit, would forge ahead; but at the time this was not foreseen by the public or the majority of manufacturers, any more than was the early eclipse of the steam and electric types, the chief products of the New England plants.

As Ford and Barthel worked on their racer, they were aware of the surge of growth that lifted the American automotive industry forward, and were especially interested in the races which accompanied and proclaimed its progress.

The great Tour of France race, ending July 24, 1899, in which cars of various countries covered a 1428-mile course, had sent a wave of talk and activity across Europe and the United States. René de Knyff in a Panhard & Levassor car had won that notable contest with an average speed of thirty-two miles per hour, a pace which indicated new

possibilities in speed and endurance.[7] Next year the tempo of racing had quickened on both continents. In the United States, electrics, steamers, and gasoline models all competed for victory on the tracks. A. L. Riker of the Locomobile Company developed a low-slung electric model which in April, 1900, won a fifty-mile race in 2 hours, 3 minutes, and 30 seconds, beating both gasoline and steam models. In September William K. Vanderbilt had won a five-mile race at Aquidneck Park, near Newport, in 8:53½. He used a gasoline-powered Daimler. However, an American model took a first place at Guttenberg, New Jersey, that same month when A. C. Bostwick, driving a Winton, won the five- and ten-mile races in 7:43½ and 15:09-1/5 minutes respectively. At Chicago later that month Winton himself led all the automobiles to the finish line of a fifty-mile race in 1 hour, 17 minutes, and 50 seconds. However, a tricycle shaved his time for the distance by more than a minute.[8]

The early races for the 1901 season were all in Europe, when Henri Fournier won the Paris-Bordeaux contest with his Mors, averaging forty miles per hour, and later was also triumphant in the Paris-Berlin run.[9] These victories made him loom large as a contestant when later that year he came to the United States. Meanwhile, Winton had essayed to cross the United States, leaving San Francisco May 20, but gave up when, after skidding through the Sierra snows, he bogged down in the heavy sand of Nevada.[10] The chief event of the season in the United States was the New York-Buffalo endurance race, starting September 9. However, as a speed limit of fifteen miles per hour was imposed on contestants, Vanderbilt, Bostwick, Riker, and Winton did not enter cars.[11] At the time Ford and his crew were building their machine, Winton was still the most renowned driver. He held the mile record on a circular track, and had been the winner in most of his contests.

The races undoubtedly stimulated the demand for cars in the United States. While home production was increasing rapidly, Americans were also buying foreign cars—probably several hundred were imported during 1900.[12] But Europeans were meanwhile beginning to purchase American cars, which had already won a name for lightness and dependability. Some American manufacturers were even now aware of the advantages they could command in the recent home development of superior machine tools, capable of greater accuracy than could be

achieved by hand, and permitting much greater volume of work. "While the largest manufacturing plant in France produces 250 to 300 vehicles a year," asserted a writer in *Automobile Topics* late in 1900, "we have manufacturing plants in this country turning out 120 vehicles weekly."[13] This statement was somewhat misleading, for no American manufacturer set such a pace regularly. Pope, Winton, and the Locomobile works could possibly do it for a time and Olds was soon to make it a norm, but other American plants could not, and many built by hand.[14] Nevertheless, the statement would soon be true of a half-dozen companies. Already manufacturers were advertising their cars, particularly in the trade and technical magazines. Winton, beginning with the *Scientific American* of July 30, 1898, was soon pushing his car every week. Less than two inches square, his advertisements carried a picture of the machine, then selling for $1000. "Always ready for use!" ran the copy, or "Never gets 'winded'!" or "Away with the whip!" By 1899 the Haynes-Apperson company had joined him and in 1900-1902 Columbia (Electric Vehicle Company), the Knox (a $750 tricycle), the Locomobile, and other cars were advertised as casually as bicycles.

Organization and display had become important factors in popularizing the automobile. In October, 1899, the Automobile Club of America had been launched, with Avery D. Andrews as President and Homer W. Hedge as Secretary.[15] It commanded a wealthier, broader, and more influential membership than the earlier American Motor League; indeed, it paralleled the Automobile Club of France, which now had a roll of 2173 members, and the similar clubs in Berlin and several other European cities.[16] In America, too, local organizations sprang up. The Automobile Club of Chicago emerged in January, 1900,[17] and by October, Detroit had a comparable body.[18]

The first automobile show aroused a mild sensation when in February, 1899, American manufacturers presented models at Madison Square Garden in connection with the bicycle exhibit.[19] The initial independent automotive show followed in the Garden November 3-10, 1900, just after Ford and Murphy had seen their first venture die; and it evoked an array of cars calculated to impress if not to dazzle the public. Thirty-four models were displayed—nineteen gasoline, seven steam, six electric, and two which combined gasoline and electric propulsion. The Winton, the Duryea, the Haynes-Apperson, the Pope-

Hartford, Pope-Toledo, and Pope-Robinson, the Autocar, the Knox, and the Packard were among the outstanding gasoline cars, with the Daimler and the De Dion Bouton representing the foreign producers. Other entries included the Gasmobile, the Meteor, the Holyoke, the Dorris, and the Upton. John Brisben Walker, promoting the Gasmobile, built a spectacular wooden hill on the roof of the Garden and put the stunt driver Joe McDuffee to work demonstrating the car's climbing, braking, and backing powers.[20] Among steam cars, the Stanley, Locomobile, and the Victor were already well-known; among the electrics, the Waverly, National, Baker, Riker, and Columbia were familiar names.

One colorful chapter in the life of the automobile was being written by the social leaders of the East. They created a special market for it at a happy time, and advertised it with lavish activities not unworthy of the Arabian Nights.

Oliver Hazard Perry Belmont, son of the banker August Belmont, is said to have ushered in this episode when he purchased a French car in 1897 and made the automobile "good form." Harry Payne Whitney and William K. and Alfred Vanderbilt promptly acquired machines and the motor carriage was soon as familiar to the wealthy group at Newport as the horse-drawn vehicle, and much more spectacular. Women took up the automobile, Miss Daisy Post being the first to drive her own—an electric—and Mrs. Herman Oelrichs, Mrs. William K. Vanderbilt, and Mrs. Stuyvesant Fish following her example. In the late summer of 1899, after the horse show and the yacht races, came the Automobile Festival. (Despite the opposition of *Horseless Age,* which advocated "motor vehicle," the French term "automobile" was becoming established in the United States.) The cars appeared in a parade, finishing at Belcourt, the Belmont residence, where an "obstacle park" had been laid out on the great lawn—a course lined with dummy figures of horses and carriages, policemen, pedestrians, and nursemaids, through which each driver had to take his way. The cars were bedecked with flowers. The Belmont automobile, for example, appeared with a basic decoration of yellow field blossoms "surmounted by an arbor of cat-o'-nine tails bearing a stuffed eagle from whose beak ran blue and yellow streamers festooned to a floral pole, upon which were numerous sea-gulls."[21]

By 1900 nearly everyone at Newport owned "a machine," and some

two or three. Residents drove to tea and dinner in cars, parking on the broad lawns of the residences—sometimes ten or fifteen grouped together. Among the enthusiastic owners were the Goelets, the Clews, the Spencers, the DeKovens, the Astors, the Harrimans, the Havemeyers, Flints, and Whitneys. In New York Carnegie and J. Pierpont Morgan joined the throng, and Paul Leicester Ford, author of the popular novel *Janice Meredith*, had his new city residence constructed to accommodate his own car and those of his guests.

The owners were not always drivers. "These women do not drive their own autos," wrote a reporter, "but use them for paying calls, for shopping and for riding on the Avenue [Fifth Avenue], and the style of vehicles which they choose are the Victoria and the brougham. The automobile Victoria, with two men in livery on the box, is certainly a very smart appearing vehicle."[22] While a number of the men favored gasoline models, the clean quiet electric was used by almost all the women.

Naturally the fashion in the East became the fashion elsewhere. Already in October, 1900, the Detroit *News-Tribune* reported that the smart set of its city was finding pleasure in the purchase of electrics, of which it estimated that fully twenty were in use.[23]

3.

This was the kaleidoscopic background of mounting production, display, advertising, wealth, and speed against which Ford and Murphy were developing their racer. Already money was to be made on the tracks—$10,000 in prizes at the Chicago races in September, 1900—but reputation also was to be acquired, a possible basis for a new commercial venture.

Ford had doubtless studied the pictures of racing models in the trade magazines; but his racer, aside from a lengthening and lowering of the body, relied chiefly on its compactness and its engine. Ford stated years later: "I designed a two-cylinder enclosed engine of a more compact type than I had before used, fitted it into a skeleton chassis, found that I could make speed, and arranged a race with Winton." Barthel's version of the work differs in that he claims to have done all the important designing himself, and to have superintended the building. "I never knew Henry Ford to design a car," he said in 1952. "I don't think he could. Mr. Ford had no draughting experience at all. He

even had difficulty in reading a blueprint. . . . Mr. Ford was a cut-and-try engineer." Barthel states that he planned the car and its engine "in its entirety from the ground up." He tells of making a road test in July, driving at seventy-two miles an hour.[24]

We need not pause to question Barthel's contribution, which was doubtless considerable. Ford was to use not only him but dozens of other men who aided notably in constructing cars that bore the Ford name. And, whether or not Ford could read blueprints, he undoubtedly preferred models, and often designed machinery by the cut-and-try plan.* But we know that he toiled long hours and kept the closest watch on all work for which he was responsible, that he got along admirably with Barthel, and that the two parted as friends in 1902. While we may be sure that Ford took everything Barthel had to offer, we may also be sure that the racing car was in a general way his own conception, and that he checked thoroughly on what was done as it progressed.

The motor had opposed horizontal cylinders, seven by seven inches. Eventually it developed twenty-six horsepower. This was low compared with some other racers; the Bolide, a French machine described in the *Scientific Amer*[illegible]
motor, develop[illegible]
meter in thirty-[illegible]
eight seconds a mile. Nevertheless, the machine Barthel and Ford were building, because of its trimness and lightness, was almost as fast. Its test performances were excellent. As the summer advanced a race was announced for Detroit which offered Ford an opportunity to show what he had done. Daniel Campau of the Detroit Driving Club, William Metzger, an energetic bicycle and automobile salesman, and Charles B. Shanks, Winton's sales manager, arranged for a contest to be held near Detroit in October. It was expected to bring the outstanding drivers of the country, Winton among them, to the city for com-

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* There is no doubt as to Ford's liking for models and his dislike for blueprints—Lord [illegible] On the other hand, Pring, Huff, and [illegible]
[illegible] what was pro-
[illegible], Olds had Jim
[illegible]ers than any of

petition. Various races were planned, including a twenty-five-mile sweepstakes event.

4.

The Fords had meanwhile been living quietly with Henry's father and sister. Clara's diary gives us some idea of their life, although naturally it is chiefly concerned with her own and Edsel's activities and with the evening hours when the entire family was together. She visited friends, often taking Edsel with her, made clothes for herself, assisted with the housekeeping, occasionally went to entertainments—she, Jane, and Edsel attended a "recital" of *Little Lord Fauntleroy*—played music at night or joined in games of cards or checkers. She never mentions books or reading aloud. Edsel was learning to write. One evening he played checkers with his grandfather. "Edsel cheated awful, and beat every game. Went to bed so full of laugh[ter] he could not say his prayers." We have a glimpse of Henry fixing an old sled and going coasting with the boy. Clara regularly took him to Sunday School. Henry apparently spent some time at the shop on these occasions, and met his wife and child afterwards.[25]

Meanwhile Clara's younger sister Kate had married a farmer, Sam Raymond, who lived near Jasper, in Lenawee County, about eighty miles southwest of Dearborn.[26] Early in 1901 Kate, then almost twenty-nine, was expecting her first child; Clara planned to be with her at the birth, and left Detroit with Edsel on February 1. She wrote Henry on February 3 that while she proposed to stay two weeks, she was already lonely.[27] Two days later she informed him that there had been a heavy fall of snow, and "Edsel is as happy as a bird toddling around in the snow. I have taken some snapshots of him. He has been making some caves." Kate was apparently feeling well. "Kate is already starting dinner and is as lively as ever, but we don't know how long it will last. She says come if you possibly can. I say so too. I put on Sam's rubber boots this morning to go across this yard. I could hardly get through the banks."

When Kate's baby was born the morning of the sixth, the brunt of the housework fell on Clara, and she found it hard. "My feet hurt me so I can hardly stand on them," she wrote in her diary on the 11th, but added, "Got great praise for my bread." On the 13th, we learn from a letter to Henry, Kate had such fainting spells that Clara regret-

fully decided she would have to stay longer than she had expected. However, a few days later the situation improved; Kate got up and a servant girl was found. Clara became impatient when she got word that Henry was ill. "Would give anything to get home tonight," runs her entry for the 20th, and the next day she departed: "very nervous about Henry," she jotted. Then, "Got home, and before the train stopped Henry got in. Was never so glad to see him because I expected he would be in bed." With her routine reëstablished, she was at peace: "Grandpa and Jane both seem pleased to have us at home," she noted on February 23rd.

The diary and letters show the family living frugally but comfortably. Clara appears as a cheerful, practical wife and mother in a lean time, uncomplaining and trustful. She lacked a certain nervous stamina which makes some women rise to meet a crisis; at Jasper she was a bit aggrieved as the work piled up. But she quickly recovered her poise. She enjoyed life as it came for the most part, and quietly radiated her good feeling—"Kate says come if you possibly can. I say so too" suggests an equable, pleasant personality with glint of humor. She must have exerted a relaxing influence upon Henry Ford, working long hours to achieve his ambitions.

Clara's diary contains a few references to his activities. Hard as he was working, he found time to paint a tricycle for Edsel. When he did not come home to supper his wife missed him: "Very lonesome," she wrote on one such occasion. On April 25 Henry "took me and Edsel back on Automobile."

Late in April Henry went on a hunting and fishing trip, indicating that contrary to his own later impression he used a gun on occasion. Clara notes that he "brought home fish and ducks." In August the three—Clara, Henry, and Edsel—made a trip to the Raymonds' farm. Kate wrote to her brother Milton that they had driven out on Sunday —"came on Auto—stayed until Mon.—left here at 11 A.M. and arrived in Det. at 5 P.M. they stopped and made Mrs. Seidel a short visit on way back, and in all made three stops from here to Det. I think they made splendid time don't you, we think it is about 80 miles from here to Det." Kate gave a brief picture of the family. "Edsel is growing quite a little I think. Clara is awfully fleshy, but Henry is awfully thin."[28] No wonder; he had been working around the clock getting his machine ready.

5.

The automobile races promoted by Campau, Metzger, and Shanks would be held, it was finally decided, at the Grosse Pointe race track.[29] This mile course, constructed on low-lying marsh land bordering the Detroit River, was described by the *Journal* as "the most beautiful in the country." Title lay with the Detroit Driving Club, of which Campau was President;[30] he and several fellow members had been responsible for getting it built.

"The big automobile races which will be held here next month," announced the *News*, "will be among the most important in the history of the sport." It added that Campau had agreed to bank the turns for a mile-a-minute pace. "The races will occur about October 10, the date being made in connection with the Chicago race. There will be four events, the feature being a 25-mile sweepstakes for $1000. In this the French champion, Fournier, will surely start. . . . The other events will include a mile dash for electric vehicles, 5-mile for steam 'mobiles and one other."

Actually the races were comparable with but no more important than a number of others held at various points about this time. Although Fournier, who was engaged in the East, did not appear, on October 9 a formidable entry list was announced. It included Winton (Cleveland), W. N. Murray (Pittsburgh), C. M. Hamilton (New York), Edgar Apperson (Kokomo, Indiana), G. A. Boyer (Reading, Pennsylvania), and many others. Earlier W. K. Vanderbilt, Jr., had [illegible] "Red Devil," a $15,000 French machine, [illegible] which he had paid an additional $7,000 in duty.

According to W. A. Simonds, the prize for the sweepstakes was a beautiful punch bowl "which Shanks [Winton's sales manager] had picked out because he figured it would look well in the bay window of the Winton dining room."[32] Ford posted his cash entrance fee for the race at Metzger's store on Woodward Avenue the day before it was held.

Promotion was completely successful in one respect: Detroiters did not under-estimate the importance of the races. Judge Phelan of the *Recorder's Court* inserted a notice in the press: "Gentlemen: This court has received several requests from attorneys and others to adjourn court

tomorrow afternoon on account of the automobile races and as there is nothing of importance on, court will be adjourned for the day at one o'clock." There had been a threat of rain, but on the afternoon of the 9th the *News* flung out a buoyant headline: "Clouds Will Go!" Detroit's smart set as well as the lawyers were on hand, and the interest of all the town's auto-minded citizens was lifted by the entry of "the Detroit chauffeur, Henry Ford." A chauffeur was then of course a more notable person than he became some years later, since most drivers were the owners of cars, and many of them wealthy. On October 6 Henry's new machine was said by the *Free Press* to have cost "something over $5000" for materials alone, Ford having "done much of the work"—presumably free—himself.[33] "His machine was tried out on the boulevard recently," asserted the *News* three days later, "and without great effort covered a half mile in 38 second[s]. This record compares favorably with the work done by Winton, Murray and Hamilton, although his car has much less horse power than theirs."

Although rated by some reporters at forty horsepower, the Ford car actually, as already stated, developed only twenty-six, Winton's and Murray's were credited with seventy. Only recently Winton had set a record of 1:14¼ for the mile, eclipsing an earlier mark by Vanderbilt. "Mr. Murray also smashed the New Yorker's record, and both men believe that the record established at Grosse Pointe will be very near if it is not actually on the minute."[34]

On the day of the race, October 10, the city was completely captured by the automobile. A parade of cars rolled through its streets, dominating the scene like a flight of giant migratory birds. "There were more than 100 of the machines in line," swore the reporter, "and not a horse in sight."[35] The electrics came first, then the gasoline and steam models. Men and women lined the streets and leaned from windows to watch the display. At the race track the horses, asserted another journalist, were annoyed. "The horse was forgotten. All around the horse were other things, large, small, white, black, red, yellow. . . . Outside along the fence, where usually are found tally-hos and coaches with their gay parties, were long rows of those things instead." It was, in fact, an "invasion of the temple."[36]

The first event of the day, a five-mile race for steam cars, was won by a little White steamer, piloted by R. H. White of Cleveland, Ohio. The time was relatively slow, the fastest mile being done in 1:52. The

electrics provided a wretched exhibition, taking more than four minutes to cover a mile! If evidence of the supremacy of the gasoline-driven vehicle was still required—and it was—these figures seemed to write it plain and large.

A mile race followed, won in 1:51⅘ by H. H. Lytle of Toledo, who beat a fellow townsman, while Stephen Hartwell of Detroit was third, and "a machine entered by Henry Ford [apparently the commercial car, not the racer] was last." Winton now drove an exhibition mile. Fournier had recently made the distance in 1:13⅖; Winton lowered it by a second to 1:12⅖, although that very day Fournier also set a new mark in New York.[37]

Because the earlier races had taken more time than expected, the original distance of twenty-five miles for the big race of the day was cut to ten.[38] Only three competitors came to the starting line: Winton, Murray, and Ford. Unfortunately, Murray discovered a leaking cylinder and withdrew. Ford made a two-mile warm-up run, the famous cyclist, Tom Cooper of Detroit, riding with him. Cooper supposedly advised the driver as to the track and the handling of the machine.[39] Then the two contestants, Winton and Ford, lined up for the race.

Both got away nicely, but Winton had the pole and hugged the fence, and Ford could not develop enough speed to pull ahead. Winton quickly proved his greater expertness as a racer. He lost little time making the turns, while Ford, although his mechanic Ed Huff "hung far out in his effort to ballast the car," had to shut off power and run wide. This may have been the fault of his steering apparatus. At any rate, "after three miles had been covered Winton was a fifth of a mile to the good." Then Ford began to improve, cut down his rival's lead somewhat on the straightaways, and on the sixth lap "shot up perceptibly." The crowd urged him on: he was both the local entrant and the under-dog. As the excitement mounted, Winton began to have trouble with a hotbox. "A thin wreath of blue smoke appeared at the rear of the machine, and it gradually increased to a cloud. Mr. Shanks, who was riding, poured oil on it, but it did no good." Ford, to a thunder of cheers, shot ahead on the eighth lap. Winton gallantly stuck with the race, but was rapidly outdistanced, and Ford swept across the finish line in 13:23⅘. It was good time, an average of about 1:20⅖ per mile, and it was victory.[40]

The race thoroughly aroused the loyal pride of Detroiters. Clara wrote glowingly to her brother Milton about Henry's triumph:

> I wish you could have seen him. Also have heard the cheering when he passed Winton. The people went wild. One man threw his hat up and when it came down he stamped on it, he was so excited. Another man had to hit his wife on the head to keep her from going off the handle. She stood up in her seat a [sic] screamed "I'd bet Fifty dollars on Ford if I had it." They were friends of ours.[41]

After the event the winner declared he would never race again. "Once is Enough" the *Evening News* headlined that decision. Ford announced his complete confidence in his machine. "Put Winton in my car," he declared, "and it will beat anything in this country."

6.

Watching at the race track on October 10 were a number of persons who then or later were to show an interest in Ford as the result of his triumph. To be sure, he had been lucky that "several brasses in Mr. Winton's machine became heated," but had his racing experience been greater he might have won in any event.

One of the interested spectators was the cyclist, Tom Cooper. A young man, only twenty-five, he had been spectacularly successful in competition. In 1899 he had been victor in so many outstanding races that he was hailed as "the undisputed champion of the country,"[42] and in 1900 had sailed to Europe, to triumph there as a member of an American team.[43] He stood five feet, ten inches, weighed 180 pounds, and was in superb physical condition, muscular, alert, ruddy-cheeked, and keen-eyed. He was not only a great athlete, but a modestly wealthy man; for he had saved a reputed $60,000 to $100,000 from generous salaries as a representative of cycling firms and the many prizes he had won. Apparently he and Ford had found something in common; Ford doubtless admired Cooper's skill and success in cycling, and Cooper Ford's mechanical ability. On the day of the victory Tom had run a motor-tandem race against time with another outstanding cyclist, Barney Oldfield, as his partner; but the crowd was automobile-minded, and their performance received "scarcely a ripple of applause."[44] Cooper announced that he was through with cycling, and perhaps was already wondering if he might find a new career in automotive racing. But while both Cooper and Oldfield would later be associated with Ford, both were now headed west, Cooper to manage a coal mine in Colorado, Oldfield to reside in Salt Lake City.[45] Neither had plans in which Ford counted.

Ford came in, sat down and "tilted back in a chair, his heels caught in the topmost rung, his knees at the level of his chin."[50] At the show he also met C. H. Sieberling of the Goodyear Tire & Rubber Company in Akron, who asked Ford to stop in Reading, Pennsylvania, on his way home and see James Reber. He wrote Ford a letter, recommending him to Reber as "a first class Gasoline Expert and Mechanic," and "the gentleman who built the machine that came within an ace of knocking out Winton's Record out at Detroit a few weeks ago."

Ford did not present the letter. However, Sieberling wrote him on November 14 and from this missive we learn definitely that Ford was already thinking of a new racer. "When you get your new racing machine," urged the Goodyear executive, "don't forget that you are to equip them [the wheels] with Goodyear detachable tires."[51]

Thus regardless of what the rich men would take in the future, Henry Ford had enough to take a trip to New York; he would soon take another to Chicago. Indeed, his financial position seems to have bettered in general. Even before the race he had moved his family into a house of their own at 332 Hendrie Avenue,[52] and Clara wrote to Milton in the December 3 letter quoted above: "We are keeping house again and are very glad to be alone. We have a very nice cozy little house. We did not build on account of Henry building the racer. He could not see to anything else. So we will have to put up with rented homes for a little longer." They had made sacrifices, but not to the point of discomfort. And by December the Fords' condition had apparently improved. The parents bought Edsel a new bicycle for his birthday, which he rode to school. This meant no small outlay. Also, reported Clara to Milton, both Edsel and Henry had raglan overcoats. "Edsel thinks he is as big as his father. You would laugh to see him imitate Henry."[53] Clearly, from the race itself (a sweepstakes, and perhaps the original $1000 was paid in addition to the punch bowl), or from Murphy and his associates, Ford had already made his racing activities pay.

He had apparently begun to think about his new racer soon after his October 10 victory. Two letters from Winton to Ford indicate such a state of mind. In the first, dated October 28, 1901, Winton writes that he will soon send the Detroiter "one of our steering posts and attachments, as I think from what I remember of your steering apparatus that there was something wrong with it, and I noticed that you had to wind the wheel around once or twice in making turns." He thinks

A group of Edison Company workers in the early eighteen-nineties. Henry Ford is the third from the right in the top row.

GLOBE HOT

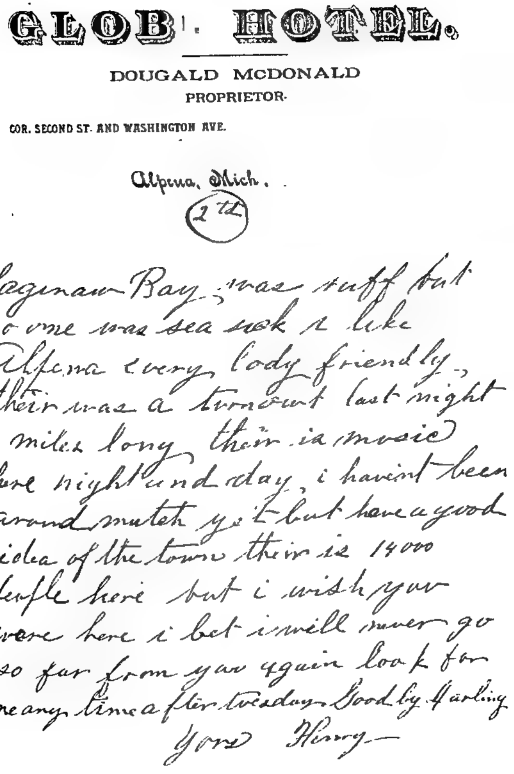
DOUGALD · McDONALD
PROPRIETOR·

COR. SECOND ST. AND WASHINGTON AVE.

Alpena, Mich. Mar 3th 1891

My C an Dear (1st) litter wife

I left Detroit about 10. o.clock for Ausable but Changed my minde on the boat came to Alpena It took 27 hours we got to Lexington about dark and i was afraid of takeing cold so i got a room and went to bed we had horses cattle and Chickens on bord the first thing i knew after i went bed was to hear the ~~Rost~~ Roosters Croing and then heard some one ask another if we ware in some ones barn yard but we we middle of Sage naw bay—



GLOBE HOTEL.

DOUGALD McDONALD
PROPRIETOR.

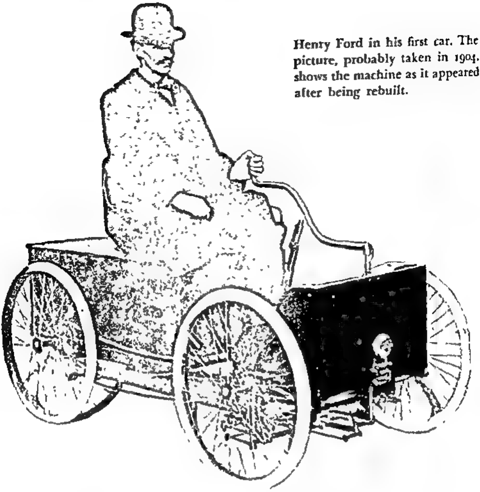
COR. SECOND ST. AND WASHINGTON AVE.

Alpena, Mich.

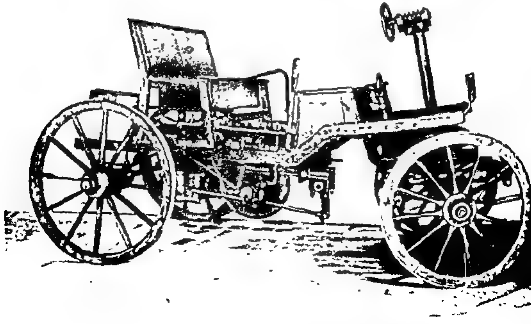
2th

Sagenaw Bay ; was stuff but
no one was sea sick i like
Alpena every body friendly,
their was a turnout last night
2 miles long their is music
here night and day, i havent been
around mutch yet but have a good
idea of the town their is 14000
peaple here but i wish you
were here i bet i will never go
so far from you again look for
me any time after tuesday Good by Darling
Yours Henry

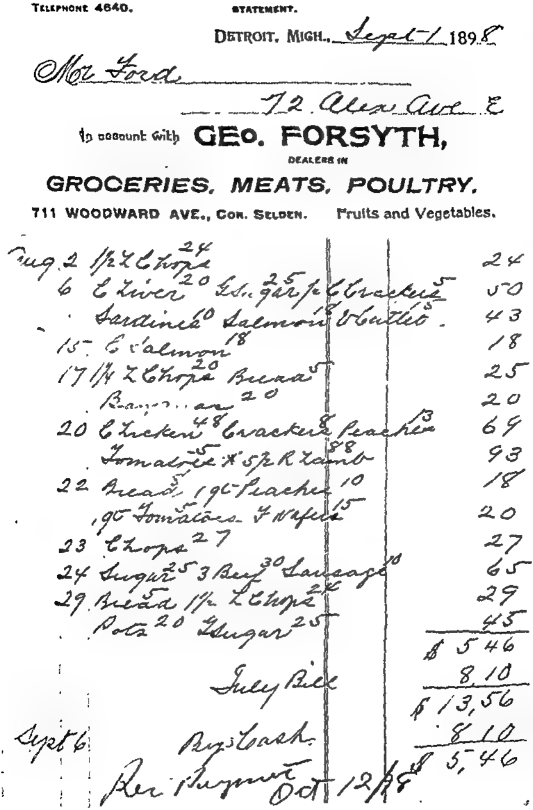
Letter of Henry Ford to Clara, March, 1891



Henry Ford in his first car. The picture, probably taken in 1904, shows the machine as it appeared after being rebuilt.



Siegfried Marcus's second motor carriage, 1875



TELEPHONE 4640. STATEMENT.

DETROIT, MICH., Sept 1 1898

Mr Ford

72 Alex Ave E

In account with **GEO. FORSYTH,**

DEALERS IN

GROCERIES, MEATS, POULTRY.

711 WOODWARD AVE., COR. SELDEN. Fruits and Vegetables.

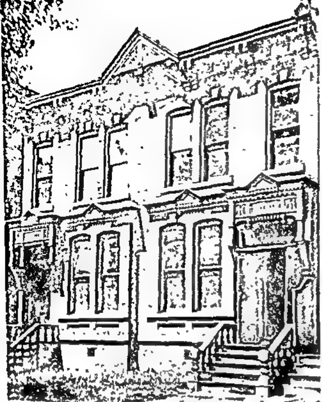
Aug 2	½ L Chops 24	24
6	C Liver 20 Sugar 25 pk Crackers 5	50
	Sardines 10 Salmon 18 Cutlets 15	43
15	C Salmon 18	18
17	¼ L Chops 20 Bread 5	25
	Bananas 20	20
20	Chicken 48 Crackers 8 Peaches 13	69
	Tomatoes 5 5 lb R Lamb 88	93
22	Bread 5 1 qt Peaches 10	18
	1 qt Tomatoes 5 Wafers 15	20
23	Chops 27	27
24	Sugar 25 3 Beef 30 Sausage 10	65
29	Bread 5 1½ L Chops 24	29
	Pots 20 Sugar 25	45
		$ 5 46
	July Bill	8.10
		$ 13.56
Sept 6	By Cash	8.10
		$ 5.46

Rec Payment Oct 12/98

A grocery and meat bill covering p [illegible] by the Fords in August, 1898. F [illegible] payment was made in mid Octol [illegible]

Clara Bryant Ford and Edsel Ford about 1899

Henry Ford in his first car



The Bagley Avenue residence of the Fords (1893–1897) and their succeeding residence on East Alexandrine Avenue. Clara and Edsel are seated on the stairs Date, about June, 1897

Ford will find the Winton mechanism better. Two days later, October 30, he writes again to say that he is getting the unit off. He apparently also borrowed Ed Huff to do some electrical work; while he wanted two coils to take to New York with him, "as Fournier is getting very uneasy and I may have to go out again and try for the record, if he breaks it."[54]

Thus Winton appears in the role of a friendly adviser who wanted to see Ford improve this car. Ford, apparently planning to do that, had perhaps already told Winton that he had a new racer in mind. It is possible that Winton hoped to drive the second machine, since Ford had publicly stated that he wouldn't drive again. "Put Winton in my car—" he had told reporters. At any rate, Winton was encouraging.

Ford's plans continued to grow more definite. He wrote Sieberling on January 2, 1902, and Sieberling in his reply remarked: "I note you are working on your new motor road-machine." He again urges his tires, offering to make a special price. "Am willing to throw away the profit on this set of tires in order to get you started and give you an opportunity to test them."[55]

All of this is pertinent to the dramatic events soon to occur. Also pertinent was the fact that after his victory over Winton, Ford had gone to Barthel and proposed that he give up his business as consulting engineer and come to the Henry Ford Company to work on design. Barthel had consented, thinking he would undertake the commercial car that the Company was expected to produce. But Ford suggested that they also start a new racer—a larger one with a four-cylinder motor. "He did not seem inclined to settle down to a small car production plan," Barthel recalled. "He talked mostly about wanting to build a larger and faster racing car. This, *together with some dissatisfaction as to the amount of interest he was to share in the company,* led to a considerable dissension between himself and Mr. Murphy, who represented the group."[56] (Italics mine.)

This dissension seems to have developed only with Ford's almost complete preoccupation with racing. It is unlikely that Murphy was at first averse to the idea of another racer. He had helped finance the first, which had done all that he and Ford had expected. To keep racing as a vital part of publicity for the new business was only good sense. As Winton, Riker, Olds, and other manufacturers used racing or endurance records, so could the Henry Ford Company. On the other

hand, Murphy knew that in developing the commercial car, the company would need Ford's individual interest and energy. This was the point of friction. For apparently Ford now became so engrossed in racing, and also so dissatisfied with the small profit he stood to win from the company, that he was ready to give all his time to his racing activities.[*] Clara's letter to Milton Bryant had fallen on good soil. Milton, seizing on her remarks about racing, apparently made tentative arrangements to promote a contest near Louisville, Kentucky, writing his brother-in-law for final sanction. Clara replied that Henry approved of what Milton had done. "We have just heard that Mr. Fournier has not gone to Paris yet, but will go some time this month. We will write him. . . . In regard to contract, Henry thinks he had better have the Louisville race first, and see how you come out, and then you can tell better what you can do. . . . Will send magazine with account of Fournier's race from Parice to Berlin. But would like you to send it back."[57]

Thus we see that Henry Ford was in a fever of enthusiasm about racing. Clara, too, was following events in Europe as well as in America. Milton Bryant, who evidently wanted to become Henry's manager, had become infected with their enthusiasm. Henry's absorption is indicated by a clipping which he enclosed from *Motor Review,* headed, "A Spring Race Meet at Springfield" [Massachusetts] on the margin of which he had written: "You can see they are agitating it early in the East. I cut this out of Jan. 2nd Motor Review, Henry." His state of mind is more plainly shown in a letter, also in the same envelope:

Dear Brother

If I can bring Mr. Fournier in line there is a barrel of money in this business it was his proposition and I don't see why he won't fall in line if he don't I will challenge him untill I am black in the face. As for managing my end of the racing business I would rather have you than any one else that I know of. *My Company will kick about me following racing but they will get the Advertising and I expect to make $ where I can't make ¢s at Manufacturing.* [Italics mine.] We are writing to Mr. Fournier.

Henry

I will write you again soon.[58]

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[*] Actually, his arrangement, with the post of chief engineer and a sixth share in the firm free, was not a bad one. In his next venture, however, his share was much larger, and he probably felt that his reputation and skill rated a quarter or a third interest.

Murphy saw that he was in danger of losing his superintendent, and protested. Indeed, Barthel recalls that he flatly forbade work on the racer. "He told me not to do it, and that he would fire me. If I valued my job, I'd better not do any work on it."[59] After this admonition, Barthel confined his labors on the racer to night hours. He himself wanted to complete it, and he did not like to disappoint Ford. Meanwhile, work on the commercial car went badly. Most writers have attributed this (with partial correctness, as the letters to Bryant show) to Ford's interest in the racer.[60] However, Ford later declared in *My Life and Work* that the Company's general policy was at fault. "The whole thought," he recalled, "was to make to order and get the largest possible price for each car. The main idea seemed to be to get the money. And being without authority other than my engineering position gave me, I found that the new company was not a vehicle for realizing my ideas but merely a money-making concern that did not make much money."[61]

In point of fact, no real evidence exists that Murphy and his associates did not want to develop a good car. The delay in doing this seems to have been in Ford's province, the shop, and after Ford parted company with his stockholders, they got out an efficient automobile rather quickly. Ford, dissatisfied with the stock he had been given, may have felt that since his share was modest he ought to be permitted to devote much of his time to making the money in racing he could not make in the Company. Actually, however, a further source of friction was involved about which both Murphy and Ford were silent, each for his own good reasons. This was nothing less than the introduction of Henry M. Leland of Leland & Faulconer into the activities of the Henry Ford Company.

In this now well-known firm Leland was the dominant figure, although Faulconer had apparently put up much of the capital, and Charles A. Strelinger was said to have helped induce the distinguished engineer to come to Detroit.[62] Wilfred C. Leland, the son, had by this time a responsible place in the organization.

Leland was probably the most experienced, farsighted, and successful director of a machine shop in America, if not in the world. Through Colt's factory and the Springfield Armory, where he had worked in earlier years, his heritage of precision engineering ran back to the great Eli Whitney. He had given able service to Brown & Sharpe of Provi-

dence. Enjoying a wide acquaintance with machine and parts manufacturers all over the country, he had learned everything he could of materials, methods, and tools, and had eagerly and creatively applied what he learned. As a result, the ingenuity of method and the standards of skill achieved by Leland & Faulconer were nationally known. To work to a 1/10,000 of an inch was not exceptional in that factory, and Henry M. Leland could supervise production requiring 1/100,000 of an inch.* The firm had devised or improved some of the machine tools and had worked out the revolutionary methods which produced the gears for the Columbia chainless bicycle and other metal products combining great delicacy, strength, and precision. As we have noted, it had manufactured motors for Olds.[63]

According to W. W. Pring, who was employed by the Henry Ford Company, Murphy became acquainted with Leland when the two attended the same church. "In that way Murphy got to know more or less about the Leland & Faulconer Company and figured there was stability there to have a man of this type. He was more or less of an adviser at first."[64] Probably Murphy procured the services of Leland as Ford began to neglect his job as company engineer, and Leland, the supreme precision engineer, quickly saw many faults in Ford's cut-and-try activities. "He figured he could tell Ford what to do, but Mr. Ford wasn't the type of man to take it, because Mr. Ford still understood that he was still in the designing end." So Pring states—it is the impression an intelligent workman received of what was happening higher up. The clash between the expert technologist and the trial-and-error mechanic was inevitable. In addition, says Pring, the stockholders were continually pressing Ford to complete a model of the commercial car and begin production. "They wanted to force Ford to say, 'This is it. We'll go ahead and make it.'"

The role Leland took in the company appears to have been a precipitating agent, if not the chief one, in bringing on a showdown. We can imagine the pressures that irritated Ford. He wasn't permitted to develop his racer on company time, he didn't have what he thought was a fair share of stock, his authority was challenged by an outsider, and he was being pressed to produce in quantity a car he did not consider satisfactory. Of course the feelings of Murphy and his associates

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* Wilfred C. Leland stated to the author in 1952 that Brown and Sharpe worked to these tolerances, and on one occasion to 1/270,000 of an inch, and that his father could direct comparable performances.

are also easily imaginable; Ford was obsessed with the racing idea, he was too much of a fusser and tinkerer, he unreasonably resented Leland's expert counsel, and he seemed to be chiefly responsible for holding back production, which the corporation must have to survive.

7.

One more factor now entered the situation when Cooper returned from Colorado. "Tom Cooper is back from the mines," noted the *Free Press* of March 16, 1902. "He has made up his mind that digging coal is not in his line and he will try to eke out an existence as a chauffeur as soon as his $4600 machine is ready for work. Meanwhile he is going in to train regularly and if he can get any one to go against him at Grosse Pointe this spring we will see some lively racing." He was building a machine, it added, with a center of gravity several inches below that of any rival. "The wheel base is about 8 inches wider than the other machines and this, he believes, will allow him to take the turns in Winton fashion, instead of swinging wide as almost every chauffeur does. Cooper will have an imported French engine, now on its way to Detroit for motor power. . . . He is anxious to race Ford here, and has offered to compete for $1000 on the Grosse Pointe track early in May."

Evidently he had been in Detroit several weeks, for on March 3 Clara wrote Milton that "Tom Cooper . . . has got the racing fever bad, he is very anxious to get a good racing car." Thus Cooper had been talking with Ford, and probably hinting at the latter's building a machine for him. Cooper and Ford may even have come to an agreement early in March. At any rate, Ford had already made his decision so far as the Company was concerned. "Henry is making arrangement [sic] for quitting everything and taking hold of racing." Cooper's interest and financial support had apparently shown him a way to what he regarded as freedom. Actually he left the Henry Ford Company on March 10, 1902. Barthel, whose statement accords with other evidence, says that Ford was given the uncompleted drawings for the racing car and $900, and that the company agreed to discontinue the use of his name.[65]

Ford and Cooper had fully joined forces by early May, for later, in telling how they were constructing two cars, the Detroit *Journal* said: "Since May 15 these two gentlemen, assisted by three mechanics, have

been building these racers with the express design of winning the world's record from William K. Vanderbilt."[66] This sentence fixes a date for the commencement of activities which would have been planned earlier.

Ford and Cooper, setting up a shop at 81 Park Place,[67] proceeded with the designing and building of "The Arrow" and "999," the latter car being named after the well-known New York Central train which had made a record run from New York to Chicago and had been exhibited at the World's Fair in Chicago in 1893.[68] What arrangements were made between the two is not known. Cooper, who had money, was certainly the chief backer of the project, although Pring and Barthel both thought that other men may have advanced something. Probably Cooper paid the rent of the shop and wages of the men and bought materials used in the cars, while Ford contributed certain plans, possibly a partly developed machine or motor, and his time and experience. The money received in his final settlement with the Henry Ford Company would have supported his family for more than half a year.

Cooper seems to have made suggestions that were incorporated in the final design, which followed the low-slung lines described by the *Free Press*. The machines were actually built, however, by Ford and a new assistant, C. Harold Wills—a young man destined to take a prominent place in the Ford enterprises. Ambitious to become a machine draftsman and designer, Wills had been trained by his father, a Welsh master-machinist, before becoming an apprentice toolmaker in the Detroit Lubricating Company. At twenty-one, his four years' apprenticeship ended, he had gone to work in another machine-shop, meanwhile studying engineering, chemistry, and metallurgy at night. Early in 1902 he appears to have been employed by the Boyer Machine Company. He knew and liked Ford, he was anxious for experience and larger opportunities, and he agreed to come to Ford's shop early in the morning and again after supper, meanwhile keeping his regular job. This arrangement may have been made in late February, before Ford had left Murphy. For compensation Wills probably looked to the future. All who knew Wills in these years, including John Wandersee and Alfred P. Sloan, Jr., were impressed by his tall figure, handsome head, and dynamic force of personality. He had a passion for mechanical design, he worked incessantly, and he possessed something of Ford's quality of vision. In short, he was just the man Ford needed.[69]

Wills took charge of drafting and design under Ford's guidance. Already familiar with internal combustion engines, he quickly improved his knowledge of the automobile. Like Ford, he had a pragmatic approach to mechanical problems. He preferred to learn by doing; in later years, when told that some technical problem was ably treated in a certain book, he would scornfully rejoin, "If it's in a book, it's at least four years old and I don't have any use for it." He and Ford, working at night in their unheated second-floor shop this early spring of 1902, would sometimes get chilled. Then, when their fingers could no longer hold a pencil or tool, they would don boxing gloves and flail each other until they felt warm! The story of this got around town—Alfred P. Sloan, Jr., from whose firm, the Hyatt Roller Bearing Company, Ford bought bearings for the rear axle of his car, soon heard of it, and Wills long afterwards told it to his son.[70]

In the shop with Ford and Wills, as the work progressed to a full-time status for both men, were Ed Huff, Gus Degener, and at the end of the enterprise John Wandersee.[71] Huff assembled the materials for the electrical units. As a completed or almost completed machine, "999" is described in the *Automobile and Motor Review* for September 27, 1902. The wheel base and the tread of the car are pronounced greater than in any other American racer—nine feet nine inches and five feet two inches respectively. Probably Sieberling supplied the pneumatic detachable tires for the wheels, which were thirty-four inches in diameter in front, and thirty-six inches in the rear. The motor developed 70 horsepower or more (Ford later said 80, and the Detroit *Journal* of September 13, 1902, gave 100!). The frame was partly a skeleton of tough wood re-enforced with steel (this was called "armored construction") and partly steel alone. "All the machinery is exposed," wrote a *Journal* reporter on September 13th. "Oilcups and polished wheels gleam alongside of black wires which lead to entirely exposed batteries. Being racing autos they are 'stripped.'" The four cylinders of the motor were seven by seven inches. "The roar of those cylinders alone was enough to half kill a man," recalled Ford. "There was only one seat. One life to a car was enough. I tried out the cars. Cooper tried out the cars. We let them out at full speed. I cannot quite describe the sensation. Going over Niagara Falls would have been but a pastime after a ride in one of them."[72] One car was painted yellow, the other red.

Meanwhile Milton D. Bryant had been tenaciously holding to his dream of managing Ford the racer. As Cooper was drawn into the situation, he proposed to accept him as a client, too. The draft of an unsigned agreement for the three, probably drawn up by Milton, survives. Cooper and Ford were to furnish the machines; Bryant was to collect the money, pay the expenses, and divide the profits among the three. Cooper wrote on June 14 encouraging Milton to arrange a contest, but politely rejecting him as manager. Milton discovered, meanwhile, that the American Automobile Association would not license anyone to hold races except a "duly organized association" acceptable to it. If any driver raced under other auspices he would be unable to compete in an Association contest. However, Milton continued to keep in touch with Henry and Clara, apparently hoping for some change.[73]

Both Ford and Cooper were worried about the cars they had developed. "I did not want to take the responsibility of racing the '999,' which we put up first," said Ford, "neither did Cooper."[74] However, Cooper recalled Barney Oldfield, who had ridden tandem with him on the day when Ford beat Winton. Oldfield, declared Ford's associate, lived on speed. "Nothing's too fast for him." Cooper wired Barney, who was in Salt Lake City, and the latter came on to Detroit. "He had never driven a motor car," Ford stated years later, "but he liked the idea of trying it. He said he would try anything once."[75]

Ed Huff had run the "999" on an Ohio track, and the machine was shipped back just about the time that races at Grosse Pointe were announced for October. Oldfield, strongly built, chubby-faced, cheerful, had arrived in town. His steely blue eyes, square jaws, and composed manner testified to his nerve. Usually a long black cigar was clenched between his teeth. According to W. A. Simonds, the machine was towed from the railroad station out to Grosse Pointe by a horse, for to drive the roaring monster through Detroit would have been to inflict nervous collapse and bodily injury on all the horses and pedestrians it encountered. Oldfield accompanied the car to the track, and when it arrived begged Huff, "Let me try it now."

Huff agreed, crouching on the framework of the car behind him. Oldfield drove capably, and Huff said, "Take her out again. You can get more speed out of her than Cooper or I." Barney continued to practice, and in a week had learned to handle the machine well.[76]

Winton was coming for the meet, and all Detroit was alert to the

impending contest between his improved car and the new Ford racer. When Ford himself did a mile in 1:08, a reporter wrote of the car, "It is a low, rakish-looking craft, and makes more noise than a freight train."

The fearsome nature of the machine is vividly described in the *Journal* of September 18. After telling how the racers in their practice runs have spattered the green fence edging the track with oil, the reporter continues:

> But the oily appearance of the fence is nothing to the look of Chauffeur Henry Ford after he had made a few dashes around the track yesterday in his new speed machine which he and Tom Cooper built. Mr. Ford was a daub of oil from head to foot. His collar was yellow, his tie looked as though it had been cooked in lard, his shirt and clothes were spattered and smirched, while his face looked like a machinist's after 24 hours' work at his bench.

This account indicates the complete exposure of the driver to dust and flying oil. Only goggles protected his eyes. The four-cylinder engine, making 1500 revolutions per minute, roared; the four exhausts at the side of the machine spurted flame; the open crankshaft was a whirling blur of motion. The steering appartus was a straight, heavy iron bar. Ford described its virtues in terms that indicate the perils of racing. "You see, when the machine is making high speed, and for any reason the operator cannot tell at the instant because of dust or other reasons, whether he is going perfectly straight, he can look at this steering handle. If it is set straight across the machine he is all right and running straight."[77] Ford does not indicate what the driver did when confused on a curve!

The race in which Ford's racer driven by Oldfield met Winton's was a five-mile event, for the Manufacturers' Challenge Cup. Just before the race, [illegible] about Ol[illegible] life with so little experience in driving. Oldfield went ahead preparing the car for the contest, answering nothing. He was determined to drive. "I might as well be dead as dead broke," he laughingly told a friend.[78] Ford himself quoted the daredevil driver as saying just before the start, "Well, this chariot may kill me, but they will say afterward that I was going like hell when she took me over the bank."[79]

Four drivers started in the race—Winton, Oldfield, Buckman, and

Shanks. Oldfield opened up at once, did not slow down for turns, and at the end of the first mile had taken a considerable lead. Winton held the pace, however, and for a time won back some of his lost ground. But by the third mile he had lost again, and the Bullet began to misfire. At the end of the fourth mile he quit. Shanks drew ahead of Buckman. Then Oldfield lapped Buckman, tore down the stretch, and defeated Shanks by a lap at the wire. The crowd, breaking into a pandemonium of cheering, stamping, and whistling, erupted over the fence and lifted the victor from his seat amid thunderous enthusiasm.[80]

The time was 5:28, an American record, and less than 1:06 per mile. (Later Oldfield did the same distance in 5:20, then in 5:15⅖, this record being made almost a year afterward and presumably showing his greater experience as well as improvements in the car. He also made a mile in 1:01⅕ on December 1, 1902.[81]) Winton declared he would design a new machine to beat the "999." Ford told reporters: "If Mr. Winton does lower this time, I'll build another machine that will go him one better if I have to design a cylinder as big as a hogshead. I am bound to keep the record in Detroit."[82]

Oldfield always believed that his contest with Winton launched him on the great career he enjoyed in automobile racing. He is reported to have told Ford that each of them "made" the other—Ford by building the car, Barney by driving it. "But," he added with a smile, "I did much the best job of it."[83]

Although Ford was ready to talk of building more racers, and actually did, this event of late October 1902, was to mark the last occasion on which his reputation was primarily that of a speedster. A coolness had developed between him and Cooper. "Henry sold his machine to Cooper two weeks ago," Clara reported to her brother Milton on October 27, 1902, "thinks himself lucky to be rid of him. He caught him in a number of sneaky tricks. He [Tom] was looking out for Cooper and Cooper only. He turned out to be just what you suspected of him. I am glad we are rid of him. I would not like you or Henry to travel with him. He thinks too much of low down women to suit me."[84]

The second racer, indeed, seems to have brought Ford back to the commercial car he had long hoped to develop. He had a backer. "Mr. Ford's name has hitherto been connected with his fast speed freaks," wrote the reporter who quoted his comment on Winton, "but he is preparing to put a 'family horse' on the market. He has it practically

completed, and in connection with a well-known Detroit business man is now looking for a suitable location for a factory. Mr. Ford believes that he will be in readiness to supply the market with a commercial article by next spring."

Thus Ford had raced his way to a third opportunity. The times were now more auspicious, and he was better prepared, although again he would not succeed as soon as he prophesied.

XI

THE FORD MOTOR COMPANY

DESPITE the hundreds of inventors who had brought their designs to life in steam, electric, or gasoline cars, despite the drama of races and the novelty of shows, despite the accolade of Newport and the birth of clubs devoted to its promotion, the automobile in 1903 was still a doubtful phenomenon to most Americans. Looming steadily larger in the national consciousness, its awkward shiny form excited wonder, enthusiasm, or derision, according to the temperament of the beholder.

Outside the great cities it was still little more than a name; millions had never yet seen an automobile. It even lacked decent roads. In the well-advertised Endurance Run from New York to Boston, sponsored in October, 1902, by the Automobile Club of America, nine cars stuck fast in loose gravel on a hill near Worcester. "The actual building of roads devoted to motor cars," *Harper's Weekly* had just observed, "is not for the near future."[1] Nor did the cost of many makes of cars promise the automobile a ready acceptance. The imported models—Panhard, Napier, De Dion, and others—were prohibitive in price except to the wealthy. What if a Royal Panhard coach seating twelve, "ideal for traveling to and from the country home," could be bought for $10,000 from Smith & Mabley in New York? What if domestic models were available at from $2500 to $7500? Such prices barred the automobile to any American of limited means.[2]

However, the moderate-priced American car was rapidly winning a foothold. Winton and Haynes-Apperson had steadily pushed $1000 models, (although their prices would soon advance), and the Olds had found an expanding market. In 1903 its manufacturers would make and sell 4000, and Ransom E. Olds himself announced at the Detroit Automobile and Sportsmen's Show early in that year that the era of fad was over and the era of utility well begun. Within a decade, he predicted, the car in general use "will be *one of 700 to 800 pounds in*

weight, small, compact, and simple in its construction."[3] Olds spoke with authority, for his $650 roadster was being marketed by twenty-six agencies and was in brisk demand. If with its leather top, curved dashboard, single two-passenger seat, rear engine, and steering rod it still looked like a crude horseless buggy, if its lines were woefully inferior to those of the sleek French Mercedes, if it had a one-cylinder engine, non-detachable wheels,* and was open to the weather, it was nevertheless a favorite with American buyers. Its very crudity of appearance was an asset, for in that day the purchaser felt more comfortable in a vehicle akin to the buggy. Many also liked a lever for steering, for at a glance the angle of the rod, as Henry Ford had noted, told the inexperienced driver (and almost all *were* inexperienced) the position of his front wheels.

Colonel A. A. Pope of Hartford, as indomitable as when he led his regiment in the final attack on Petersburg, was also making a cheap car—the Pope-Tribune. This six-horsepower runabout with engine in front was to go on the market early in 1904 for $650. His Pope-Hartford, with ten horsepower, cost $1200 with tonneau—i.e., a detachable rear seat for two. Pope also made the Pope-Robinson (gasoline), the Pope-Waverly (electric), and the Pope-Toledo (gasoline). The Auburn Company was turning out a moderate-priced car at Auburn, Indiana, and the Century Motor Vehicle Company of Syracuse advertised a $750 steamer.

Besides a dozen other cars of varying prices whose names were now known—the Franklin, the Marmon, the Pierce, the Stearns, the Locomobile, the Dorris, the Rambler, the Packard, the Stanley, the Knox, the Gasmobile—there were newcomers in the field. In 1903 the industry was still widely scattered as to points of manufacture, with Pope producing in Connecticut; Winton, Stearns, and Packard in Ohio; Pierce in Buffalo; the Stanley, Gasmobile (American Automobile Company), and Locomobile in Massachusetts; the Premier in Indianapolis; the Duryea and Autocar in Pennsylvania; the Dorris (St. Louis Motor Car Company) in St. Louis; the Jeffery Company in Kenosha, Wisconsin; the Olds in Detroit. But new firms now springing up in Michigan indicated the trend to the West.

Thus the Cadillac, successor to the Henry Ford Company, was de-

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* It would be some years before the English device of detachable wheels and mounted spare would be generally adopted in the United States.

veloping in Detroit under the guidance of the brilliant Leland; the Packard had established a branch in the city and would soon move there; and in the spring of 1903 the Buick Motor Company would be incorporated in Detroit with a capital of $100,000.[4] It was to produce a moderate-priced car with a valve-in-head engine and the slogan, "When Better Automobiles Are Built Buick Will Build Them." The city numbered other firms, notably the Northern, Reliance, and Mohawk; the last-named announcing in the summer of 1903 that it would take over Oliver E. Barthel's inventions and would sell its machines at "popular prices."[5]

Expansion, exuberant and often reckless, was a dominant characteristic of the industry. New companies seemed to spring to life daily. Many like the Century, the Waltham, the Overman, and the Mohawk would soon fall by the wayside; others would endure. But the birthrate was astounding and the death rate high.[6]

Nearly all the early automobile works in America, like most of those in Europe, still did little more than assemble engines, wheels, bodies, and other parts made for them by various dealers. So eclectic was the character of many cars that James Gordon Bennett, in offering his cup for an international race of not less than 500 kilometers, stipulated that every competing car must be built wholly in the country that entered it. (The first two races were won by French cars, and the third by a fifty-horsepower Napier.) By 1903 the trend toward the self-contained automotive plant had already begun in America.* Still, few companies in the United States had the skill, facilities, and capital to build an automobile complete, and even those with the requisite resources for such a task were patronizing the parts makers, particularly for engines, bearings, bodies, wheels, and tires. The Olds motor works, rapidly expanding its plant on East Jefferson Avenue in Detroit, and now said to be the largest factory of its kind in the world,[7] purchased its bodies from the C. R. Wilson Body Company on Cass Avenue, and its engines and transmissions from the machine shop of John and Horace Dodge at 240 Monroe Avenue. When Dodge Brothers could not fill the orders sent them, Olds contracted with Leland & Faulconer to supply the remainder. This firm was employing five hundred men in its Twombly Avenue works in the summer of 1903. Making machine tools, gears, and gasoline engines for cars, boats, and power-houses, it

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* As will be seen later, the Association of Licensed Automobile Manufacturers, operating under the Selden Patent, took a stand against mere assembly plants in that year.

supplied a broad market. The Olds Company got still other parts from a variety of dealers.

If trends were hard to discern in this exuberant growth, they would soon become marked. The exotic foreign-built car, a rich man's plaything, would be imported for years to come, but its importance in proportion to the total cars in use would steadily diminish. The high-priced domestic car would continue to find buyers among the wealthy and fastidious who prized style, size, and power. But with a widening use of the automobile the medium-priced car would gain an ascendancy; and later as tradesmen, mechanics, and farmers demanded utility vehicles, and as mass production became more common, a great field would open for the low-priced car. In brief, the price trend during the next decade would be downward, until the main weight of the automotive industry rested solidly on two plateaus: a broad medium-priced level and a much broader and more stable low-priced level.

Decentralization in manufacture would meanwhile yield to inexorable pressures, soon to be described, which tended to make one Mid-Western state, Michigan, the capital of the automotive industry. That trend was fairly evident by the end of 1903, when estimates already credited Michigan with the manufacture of nearly half the motor vehicles of the country. Its neighbor Ohio, the nearest competitor, made little more than one-third as many.[8] Within Michigan, although towns like Lansing, Flint, and Pontiac were to become famous in the automobile world, Detroit had assumed a dominant position. As the industry grew, a trend toward vertical integration would naturally be felt; that is, the factory that was merely an assembly plant would give way to those that made half or almost all the components of a car. And with further growth still another trend would appear, lifting American production to worldwide distinction and leadership: the trend toward that systematic combination of accuracy, speed, and volume in manufacture which can be summed up in the much-used but little-understood phrase "mass production."

These great trends, and the leadership which notable groups of men would furnish in helping to create and guide them, would give unusual drama and color to the early history of automobile manufacture.

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Of all American cities, Detroit by 1903 was the most familiar with the automobile. When the year opened, eight hundred cars were said

to be in use there. Many residents had "motor houses" for their machines. The larger factories were among the sights shown to visitors. During the summer the Packard Company was erecting at Concord Avenue and Grand Boulevard its large new works designed by Albert and Julius Kahn, architects and industrial engineers. The buildings had been so arranged that the rough stock would enter at one end and be moved forward, department by department, in order of the work to be done upon it, operation following operation with a minimum of handling and cartage. The metal parts were sent through the machine shop to be shaped and drilled, meeting the wooden or aluminum bodies in the assembly room; here they were put together and sent on to the body-painting department, the varnishing department, the upholstering department, and the finishing department, emerging at last in the testing room.[9] Even more impressive was the plant of the Olds Motor Vehicle Company as seen by a reporter for the Detroit *Free Press* in the spring of 1904:

> Rows upon rows of special machinery are humming and buzzing away, bewildering the onlooker with their number. A great expanse of floor space stretches away before the visitor, along which are arranged these ingenious devices, each with its own peculiar work to do. Some bore out the cylinders, each machine making two cylinders at a time; some finish the connecting rods and shafts; in fact, every step in the process of turning out the finished machinery of a modern car is carried out by a group of these beautiful machines. . . .
>
> In the assembling room the same orderly process is to be observed. The engines move along from one group of men to another until they are ready for the car, thoroughly tested and proved worthy of use. The finishing and enameling of the bodies, the upholstering of seats and cushions, and so on, are carried on in a large separate part of the plant. One little imagines, as he looks at the swiftly running car on the street, the immense amount of detail and careful manipulation that have been necessary on the hundreds of parts before they have all been brought together and adjusted to form this engine of commerce and pleasure.[10]*

With the large Olds, Cadillac, and Northern factories Henry Ford had of course some acquaintance, but he felt no doubt of his ability to compete with them once he got a fair start. The collapse of his early ventures in automobile manufacturing left him determined, as he said

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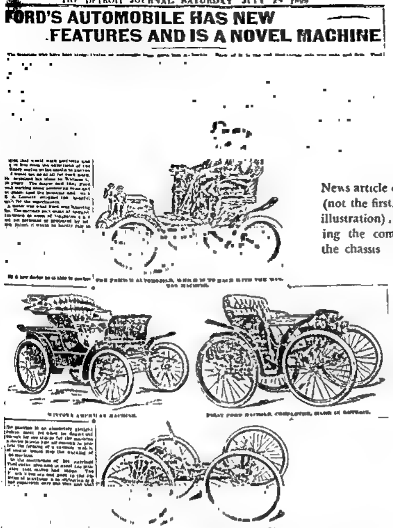
* An article on "Automobile Industry and Trade in Detroit" in *Automobile*, IX, No. 24, December 12, 1903, shows that progression of work was emphasized at the Olds works: "The motors are passed, step by step, down the assembling bench toward the testing department which is in the next room, a new piece being added at every move with clocklike regularity."



THE DETROIT JOURNAL, SATURDAY, JULY 29, 1899

FORD'S AUTOMOBILE HAS NEW FEATURES AND IS A NOVEL MACHINE

News article on Ford's second car (not the first, as stated under the illustration), with sketches showing the complete machine and the chassis

Barney Oldfield with Model 999

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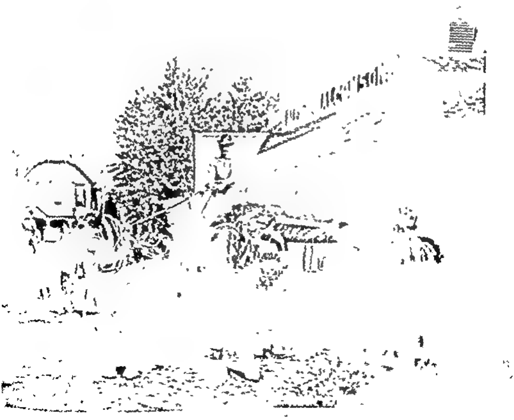
Residence at 332 Hendrie Avenue, where the Fords lived when the Ford Motor Company was incorporated



Interior of A. Y. Malcomson's coal office, *1905; Malcomson* on stool at table. Couzens, with wing collar, standing at desk. The bearded man with cigar is possibly John S. Gray; man at extreme right unidentifiable.

soon afterward, to put a "family horse" on the market.[11] The first step was to enlist capital, and to get capital he had to prove anew his superior mechanical skill. He began sometime in the late spring or early summer of 1902 to plan a medium-cost machine with one strikingly novel feature, a vertical engine in place of the horizontal engine used by Olds, thus reducing vibration, noise, and wear. He soon had rough designs ready for a pilot model. It was necessary to get a little money for parts and helpers; his original estimate was $3000, but the eventual cost came to about $4000.[12] For funds he approached a business friend.

This businessman, who proved responsive, was a coal merchant of Scottish blood, established position, and all too boundless enterprise named Alexander T. Malcomson. Thirty-six in the fall of 1902, "with mutton chop whiskers and a long nose," he had gone into the coal business nearly a decade earlier, buying a small yard on credit and making deliveries with a single horse and wagon. By hard work, willingness to take risks, and fair dealing (he refused to profit from occasional coal famines) he prospered. With offices at 176 Griswold Street and a growing number of yards, including two on the Michigan Central, he made every Detroiter familiar with his wagons bearing the slogan, "Hotter Than Sunshine." He supplied not only thousands of households, but steamships, railroads, traction lines, state institutions, and factories. He owned a thousand acres of coal land in West Virginia and had an interest in the Crescent Fuel Company of Toledo. Years earlier, he had known Ford as a slender, angular man who bought coal for the Edison Illuminating Company. The two had continued to see each other, for Ford still bought his home coal from Malcomson, and sometimes met the merchant at the Episcopal Church, where Malcomson was superintendent of the Sunday School.[13]

As the year 1902 advanced, Ford had talked about the potentialities of the automobile to Malcomson, who had gradually imbibed much of his enthusiasm. Finally, they decided that Malcomson would pool a little capital with Ford's designs and engineering skill.* On August

20, 1902, they signed an agreement for a partnership, under the style of Ford & Malcomson, to bring an automobile upon the market. Ford was to assign the merchant a half interest in all his patents present or future; to convey to the partnership all tools, dies, models, drawings, or supplies of any kind which he held or might get; to hand over one racing car on its completion; and to devote his time to building a model automobile for exhibition. Malcomson was to contribute $500 at once and further sums as they might be needed. Once the model car had been built and had attracted capital for its manufacture, a corporation would take the place of the partnership, absorbing all its assets. Ford and Malcomson covenanted that they would hold equal shares in a majority control of this corporation, and that neither would sell without the consent of the other. Malcomson was to take charge of the financial and commercial business of the company, Ford of the mechanical and manufacturing divisions.[14]

Shrewd businessman though he was, Malcomson was essentially a plunger, impetuous and excessively sanguine. Having expanded his coal operations too rapidly, he was being given heavy credits by Detroit banks and possessed little ready cash. He stipulated that nothing was to be said to the bankers about this new undertaking. The bills were to be paid from an account opened in a new bank in the name of James Couzens, Malcomson's clerk, office manager, and business adviser.[15] Sometime in August or early September, 1902, occurred a memorable meeting: Couzens shook hands with Ford.

By the date of the August agreement with Malcomson, Ford almost certainly had drawings and blueprints, on which the skilful C. Harold Wills had collaborated, to show his new partner. At the moment Ford was preoccupied with the impending Grosse Pointe Race, on which, as we have seen, he counted for both advertising and prestige. But not all the hard work which he, Wills, and "Spider" Huff expended that summer in their dingy shop at 81 Park Place went into the racer "999"; some was given to the car in which Malcomson was interested. Next door was the Parker-Webb Building, where they had a modest office for drafting and miscellaneous work. Ford was living on his savings, though one observer believed that Wills split with him a salary of $125 a month paid by Malcomson. Then came the victory of the "999" on October 25; and on the wave of enthusiasm and publicity created by that triumph, everyone concerned bent enthusiastically to work on

the new car. Malcomson parted with funds more easily. The cautious, vigilant Couzens, who at first had felt no great faith in the venture and was worried by the mounting charges, grew less suspicious.

In choosing Childe Harold Wills (who carefully suppressed the Childe!) for his principal shop assistant, Ford had gone far toward guaranteeing the success of his enterprise; for in the design of all the company models of the next dozen years, it is impossible to disentangle Ford's work from that of Wills. The tall, handsome young man, of proud, stiff temper, had a touch of genius. He owed much to his Welsh father, much to the Detroit tool-making shop where he had served an apprenticeship, much to his hard night study of drafting and design. Highly industrious as a young man, he would toil a long day with only a sandwich and glass of milk at noon. In time he rose to be head of his own Wills-St. Claire automobile company. He had a passion for mechanical design; often after dinner, according to his son, he would sit at table drawing plans and setting himself problems; and save for brief fishing, hunting, or yachting excursions, he never stopped working. While not aggressive, he was direct, positive, and imperious, made up his mind quickly and completely, and was so persuasive that (said an intimate) he "could convince you black was white."

Two partnerships were to shape the history of the Ford Motor Company in its first dazzling rise: the partnership of Ford and Couzens, and the partnership of Ford and Wills. The first was a union of opposites, attended by no real liking; the second was a union of men of generally congenial tastes and ambitions who instinctively understood each other. Wills, say his associates, "saw all around any mechanical problem"; so did Ford. The two men shared an interest in social problems—Wills later tried to build a model industrial community at Marysville, Michigan; they had the same taste for outdoor life; they showed the same ease in gaining technical expertness—Wills became perhaps the greatest practical metallurgist in the country, developing important steel alloys. It was fitting that Wills should be responsible for the style of the name FORD in all the company advertising. As a boy of fifteen or sixteen he had earned some money by making calling-cards, for which he used type in a flowing script. When the company first grappled with publicity, nobody was satisfied with the appearance of the name. Wills rummaged an attic for his old printing outfit and lettered the FORD in its familiar style. The design, at once accepted, endured for half a century.

"I think," declares Fred W. Seeman, a veteran Ford employee, "Mr. Wills and Mr. Ford got along about as well as any engineering couple I've run across in my life, and I've run across a lot of them." It was always plain that Ford was the abler of the two—he "had more gadgets in his head" than anybody else, testified another worker; he had much the broader outlook; his was a more fascinating personality. Wills had certain weaknesses: a taste for display, shown in his love for fine jewels, which he often carried in his pocket; a liking for gay society; and a marked hostility to shop discipline. But Ford required his talent for design in the shop as he needed Couzens' method and energy in the business office.[16]

In October, Ford and Wills began to hire a labor force. On the 17th a friend of Wills's, a bright, eager young mechanic named John Wandersee, was put to work; he had been born on a Wisconsin farm and trained in Milwaukee and Detroit machine shops. From the Chicago Pneumatic Tool works came two other capable mechanics, Harry Love and Walter Gould. A pattern-maker was found in Dick Kettlewell, a naïve young fellow on whom Ford liked to play practical jokes. A draftsman and a blacksmith were needed; August Degener, a smooth-faced, bulging-eyed German lad, and the brawny Charles Mitchell filled these places. In November a very intelligent Canadian mechanic, Fred W. Seeman, was employed; his recollection that he got thirty cents an hour for nine hours gives us a clue to the general scale of compensation. Later on, Frederick Strauss took charge of the shop under Ford and Wills.

A very rudimentary shop it was; they had only two lathes, two drill presses, a milling machine, a wood planer, a hand saw, a grinding wheel, and a forge—no specialized tools whatever. But they worked energetically: Ford had the general idea of a light, simple, low-priced machine, and some notion as to details; Wills helped to make the general conception specific, offering numerous suggestions as to separate units, and putting the plans they agreed upon into blueprints; and the others made and fitted parts.[17]

"Hope you can get everything running in good shape at the shop," Malcomson urged Ford in a letter written on October 30, "so that the work can be pushed with all possible speed. Our salvation next season will lie in getting the machine out quickly and placing it on the market early. It is pleasing that you have been so successful in getting the right

kind of help. Mr. Couzens and I called at the shop last week and found quite a change, it is taking on quite a business aspect."[18] Wills drove his hands so hard—himself setting the pace—that some thought he had a surly, difficult disposition. Ford liked him all the better for his severity. "In order to get along with Mr. Ford," runs the significant comment of one company pioneer, "you had to have a little mean streak in your system. You had to be tough and mean; Mr. Ford enjoyed that."[19]

By Thanksgiving the motor for the model car had been finished. The chassis was being hammered out of angle-iron in the shop. A body was supplied by B. F. Everitt, the largest maker of automobile trimmings in the country, whose plant on Fort Street was perhaps the best equipped in that line in America.[20] Wheels and other parts came from outside. Between Thanksgiving and Christmas, 1902, the force was busy assembling the car so that it could now be exhibited and orders for it accepted. But where were the funds to start production and marketing in quantity?

In November, Ford and Malcomson carried their formal agreement a step further. They decided to form the Ford & Malcomson Company, Ltd., with a capital of $150,000 divided into 15,000 shares. Of this they would take 6900 shares in return for their patent rights, designs, and the time, money, and effort they were spending. They would also pay $3500 in cash for 350 additional shares. This would leave 7750 shares to be sold.

But who would buy them? The automotive industry, growing by leaps and bounds, was a pioneer business, with not only able men like Pope, Winton, Olds, and Leland, but plenty of rough and ready speculators. Capitalists were wary because so many shoestring enterprises and flamboyant promotions had failed. Some crooks sold stock and disappeared. Some reputable men, to avoid bankruptcy, used desperate expedients. They even loaded freight cars with junk; issued bills of lading, and drew sight drafts on distant retailers, cashing them at the bank; and then, when the consignees complained, loaded another car —if they were able—with the missing machines. One wealthy man told an officer of the Curtis Publishing Company that he had looked into the business with real interest, but abandoned the idea of investing: "I had so much more capital than all the others in the game that I thought I had better stay out, and keep it."[21]

James Couzens, trudging from one prospective investor to another, received rebuff after rebuff. One businessman dismissed him so brusquely that, as he later recalled, he walked downstairs and sat on the curb almost in tears.[22] When Ford tried to interest his former boss, Alexander Dow of the Edison Illuminating, that hard-headed man replied that he was "too busy" for any speculative venture. Not until 1903 was well advanced did the partners make any material progress. For several months they pushed ahead on faith, hope, and nerve.[*]

Malcomson in December, 1902, had bought a small coal business on the belt line railroad at Mack Avenue, thus becoming leaseholder of a coal-yard and an old wagon shop there owned by Albert Strelow, one of the largest painting and carpentering contractors of the city. He persuaded Strelow to remodel the wagon shop, according to Ford's designs, for use as an automobile assembling plant. This cost $3000 to $4000, but Malcomson and Ford agreed to pay a rent of $75 a month for three years.[23] Three months' work put the place in sufficient order to enable Ford to bring over his equipment and working force on April 1 from the Park Place Shop.[24] For power, they installed a large Olds gasoline engine, to which Degener hooked up the lathes, milling machine, planer, and other tools. Though the first car had operated fairly well, Wills and Ford had not been satisfied and toiled all winter at another and better one, the progenitor of Model A. It was well that they did so, for sometime early in the year Degener and Wills, driving the first machine on Mack Avenue, wrecked it. While Strelow was getting the shop ready, the ambitious manufacturers—still without any appreciable cash capital—began approaching parts makers for contracts.

3.

As the most vital part of the new car was the engine, so the engine contract was the essential element in Ford and Malcomson's early business arrangements. The Dodge Brothers, John F. and Horace E., had one of the best machine shops in the Middle West, doing a wide range of business. A reporter who had visited their establishment eighteen months earlier to write one of the stock booster articles of the day professed to be delighted by its order, cleanliness, and efficiency. No smells,

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[*] According to the lawyer John W. Anderson, Alexander Malcomson's cousin, a member of the architectural firm of Malcomson, Higginbotham & Clement, took a hand during the fall in trying to raise money; and he may have drawn the contractor Strelow into the venture. (Additional Tax Case, *Transcript of Hearings*, 1273.)

no deafening noise, no litter, he commented; no worn-out or obsolete machinery. "The thoughtful arrangement of the different machines so that the many delicate or ponderous articles at all times in process of construction may be handled with ease and the greatest rapidity possible, is noticeable." It is true that the Dodge Brothers did an amazing variety of machine work with more than average skill and precision. They were proud of a "four point bearing bicycle" they had invented and manufactured, and of a steam launch, the *Lotus,* which they had designed, built, and raced with great success.[25] When Ford asked them to supply 650 chassis (engines, transmissions, and axles) for his first season, they were considering contracts offered by the Olds and Great Northern companies. But faith in Ford's engine designs and hope of a larger profit from the new enterprise led them to sign a formal agreement with him and Malcomson on February 28, 1903.

The Dodges contracted to supply the 650 chassis for $250 each, or a total of $162,500. They were to deliver the machinery to the Mack Avenue assembling plant ready for wheels, tires, bodies, and related parts. Ford and Malcomson agreed to pay the first $5000 on March 15 if the Dodges could then show that they had invested that sum in machinery, tools, and materials to be applied to the Ford contract, and the second $5000 a month later if the investment had been doubled. When the first engines and gears had been delivered, and the Dodges' investment had reached $15,000, still another $5000 was to be paid. This total of $15,000 was to foot the bill for the first sixty engines delivered; the next forty were to be paid for in cash as completed; and thereafter the Dodges were to receive semi-monthly payments. If Malcomson and Ford failed to make their payments, all unsold machinery would revert to the Dodge Brothers.[26]

This contract, advantageous to both sides, suggests a strong mutual trust between Ford and the Dodge Brothers, who had been acquainted for years.* Temperamental though the Dodges were, poorly educated, and somewhat dissipated, they were excellent businessmen. Alike in being red-haired, quick-tempered, and always ready to quarrel with anybody or each other, they differed in other traits. John was a dy-

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* [illegible] death of the Dodge brothers, he was deeply [illegible] also de- [illegible] $75,000 [illegible] Dodge [illegible] Actually the Dodges grew rich from their contract.

namic, aggressive, talkative man, with a gift for leadership; Horace was usually quiet, easy-going, and slow. They were bound by ties of the closest affection, refusing to be parted. They had left their boyhood home in Niles, Michigan, early in the 1880's, found jobs and experience in various machine shops in Detroit and neighboring Windsor, and risen to mastery of their calling. A hand at a Windsor factory has left a record of how he saw the two young redheads apply for work. "We need only one man," growled the superintendent. Retorted John Dodge: "We're brothers and we always work together; if you haven't got room for two of us, neither will start. That's that!" They got the jobs, and John was soon superintendent himself.[27]

Both liked to go down to the roughest quarter of Detroit on Saturday night, find a favorite saloon, and drink until some friend had to drive them home. Once John in his cups had ordered the proprietor to dance. When he refused, John pulled out a revolver: "I mean what I say, and I want you to get up on that table and dance!" The frightened man obeyed while the elated John Dodge threw glasses at the bar mirror by way of applause—paying a steep bill a few days later.[28] But these bouts did not interfere with their hard weekday work. Getting a complete experience, they started their own jobbing shop, saved money, and prospered. Their large, well-equipped establishment in 1903 was at 240 Monroe Avenue. During the spring of 1903 it was practically turned over to work for Ford and Malcomson, with 150 men employed in making engines and transmissions.[29]

The Dodges guaranteed that their materials and workmanship would be of the highest quality, stood liable for any defects, and promised to sell no Ford parts to outside agencies and to make no repairs on Ford cars without consent of Ford and Malcomson. Of course all designs came from Ford and Wills. The brothers hoped that the contract would grow into a huge business.

A little later in 1903 Ford took steps to solve the carburetor problems, which had stumped him and Wills. The Kingston carburetor attached by the Dodge Brothers was unsatisfactory. Ford had seen in the *Cycle and Automobile Trade Journal* an account of an improved carburetor made by a young man in Bradford, Pa., named George Holley, who had achieved a considerable reputation by manufacturing what he called the "Holley Motorette," a little single-cylinder car, by making motorcycles, and by turning out in quantity a simple but prac-

tical carburetor. To Holley, an eager, fresh-faced youngster, mechanical work was the very breath of life. On his own motorcycle he had made a perfect record in a Boston-New York endurance contest. His carburetor was better, he thought, than the Longuemare carburetor which he had seen in France and for a time copied, or the carburetor of Charles Duryea which he had seen in Springfield, Mass. Ford telegraphed Holley, who hurried to Detroit.* "I found Mr. Ford with Mr. C. H. Wills sitting in the pattern shop on a bench," he later recalled, "and they told me they would like to have me design a carburetor for their new car."[30] This he did with satisfactory results. Holley's association with the Ford Company was destined to be long and mutually profitable.

Bodies? Malcomson and Ford contracted with the C. R. Wilson Carriage Company for wooden bodies at $52 and cushions at $16 each.† Wheels? They arranged for tires from the Hartford Rubber Company at $40 the set of four, and wheels from the Prudden Company in Lansing at $26 a set. The cost of the principal parts was thus $368. If the engine was as superior as Ford believed it, and if the demand for cars continued keen, the partners should be able to market their machines at a fair profit.

They pointed this out to possible investors—but capital still remained aloof. One reason why money was hard to raise was that Malcomson was over-extended, debt-ridden, and too busy to pay much attention to his automobile venture. In rapid succession in the winter of 1902–03 he bought the Rohrig, the Alexander C. McColgan, and the Jewett, Bigelow & Brooks coal businesses. He tried to persuade Harry M. Jewett to put some of the money he received into the automobile venture, but Jewett, who later became head of the Paige Motors, thought the undertaking "too much a gamble."[31] By April Malcomson had ten coal yards, with a storage capacity of 365,000 tons, and was trying to keep 110 wagons and 120 horses busy. Among those from whom he borrowed heavily was his elderly uncle John S. Gray, who though himself a Scot, was president of the German-American Bank.

When an acquaintance asked Malcomson whether he was not wor- [illegible]

[illegible]

[illegible] works consisted of automobile bodies for Olds, Cadillac, and Buick.

ried over his ability to sell automobiles in time to pay the bills for parts, the merchant said he hadn't even thought about it. "I haven't got time to worry," he remarked. "I've got a big coal business, and I'm working here day and night." Trying to ride two horses at once, he gave only intermittent attention to the automobile undertaking, leaving that to young Couzens.

As a matter of fact, investors knew that automobile manufacturing, still in its experimental stage, was a highly precarious field. While a few men obtained glittering rewards, many suffered heavy losses. The year 1900 had found at least 72 American companies making cars; in 1901 38 more had entered, and in 1902 47 more. This year, 1903, was to see 57 new entrants! How many of these companies lasted even a year? Of the 38 that plunged into the business in 1901, 13 died within the twelvemonth. In the year that Malcomson and Ford (with 56 other hopefuls) entered the game, 27 companies new and old dropped out, and three turned to another line of business. Next year 37 companies retired and four turned to another line. In short, relatively few enterprises stayed in the course and won substantial fortunes for their founders; a majority came to grief, and literally hundreds of them in the first decade of the century must have lost most of the money invested. According to a careful historical table compiled in 1909 for *Motor* by C. E. Duryea, who gave it months of work, the total number of companies formed to manufacture automobiles 1900–1908 inclusive was 502; and the total number which retired from business altogether was 273, while 29 more entered some other area. Three-fifths of the whole roster were failures.[32]

If a man stood three chances in five of losing what he put into the Malcomson-Ford enterprise (and on its small capitalization the risk looked greater) what wonder that investors turned away?

But the partners worked hard to raise money. In early spring a young man who had done much to make the Daisy Air Rifle a success, Charles H. Bennett of Plymouth, Michigan, visited Malcomson's office. He wanted a car and had thought of an Oldsmobile, but had been advised by a cousin of Malcomson's to look at the Ford model. Malcomson telephoned Ford, who forty-five minutes later had his car in the alley back of the building. As they drove up and down Gratiot Avenue, Ford explained its advantages. "Naturally," he said, "we're going to hold it down to somewhere near the Olds price." Bennett, impressed by Ford's expertness, promised to wait for one of the new cars.

It occurred to Malcomson and Ford that if the makers of the Daisy Air Rifle could be drawn into the enterprise, their resources would be invaluable. "We'd have a place to start," they frankly told Bennett. "We'd have a name sufficiently well known for credit." Ford then visited the Daisy manufacturers in neighboring Plymouth, and proposed that when the Ford Motor Company took the place of the partnership, the Daisy men should underwrite half the stock, he and Malcomson keeping the rest.[33]

For a time it seemed that the plan might give the new company a flying start. Bennett and his partner Ed Hough, inspecting the Ford engine at the Dodge works, concluded that it was better than any other yet placed on the market. But when lawyers were consulted they objected that the charter of the air-rifle company did not permit it to buy stock in another concern, and that if the two companies became partners, all the Daisy stockholders would be liable for any losses by the Ford Company. Perhaps some expedient could have been devised, but in the end Hough flatly said no. The upshot was that Bennett invested $5000 of his own in the Ford Motor Company, and at once began taking an active interest in the management.[34]

Others were gradually drawn into the enterprise. Had men been able to look ahead only three or four years—had it been possible to guess that the Malcomson-Ford undertaking would prove one of the richest Golcondas in history—Mack Avenue would have been thronged with investors; but what men *did* know was merely that Malcomson was an impulsive plunger, that Ford had one business failure and a withdrawal from a second venture behind him, and that automotive manufacturing already seemed dangerously overcrowded. One by one, however, prospective investors began to say yes. Malcomson's cousin Vernon C. Fry was willing to risk some money. So were his two attorneys, Horace H. Rackham and John W. Anderson. Couzens was converted to a passionate faith in the enterprise. He had kept warning Malcomson of the mounting bills, but he had also kept getting more firmly identified with the project. Most important of all, the banker John S. Gray was drawn into a commitment—on terms very favorable to himself.

When the first $5000 fell due to the Dodge Brothers on March 15, 1903 (for they had invested more than that in machinery and materials), they were insistent on payment. What was more, they would demand the next $5000 on April 15. A crisis occurred, with a stormy

meeting of Malcomson, Ford, Gray, Couzens, and the Dodges. As a result, Gray agreed to advance the $10,000 needed, with an extra $500, on condition that he be allowed 105 shares in the company, that he be made its president, and that if he became dissatisfied with his investment within a year, Malcomson would repay him.[35]

"I'm quite sure," states C. H. Bennett, "that the reason that Mr. Gray was made president instead of Mr. Ford at that time was because of his banking facilities, for one thing, and because he was deeply interested in what Mr. Malcomson was going to get out of it to pay up his debt at the bank." *

By the time the June heat descended on Detroit, preparations for work were nearly finished. The Mack Street building had been completed—a light, airy assembling room, about 250 feet long by 50 wide, which observers pronounced a "dandy."[36] Machinery had been installed and tested. Parts for the new car were now beginning to arrive in quantity. Ten or a dozen workmen, hired at $1.50 a day each, were ready under Degener's supervision to fit the tires on the wheels, put the wheels and body on the machines, install the cushions, paint the vehicle, and test it.[37] "That is all there is to the whole proposition!" wrote the young attorney John W. Anderson to his father, a La Crosse physician. "You will see," he added, "that there is absolutely no money to speak of tied up in a big factory."[38] Shoestring finance was seldom better exemplified; the venture had just barely money enough to start with the greatest simplicity of operation and the lowest of overhead costs.

Anderson's letter to his father, from whom he wished to borrow $5000 to invest, shows that Malcomson, Ford, and he had an enthusiastic faith in large immediate returns. The cost of all the parts, according to their estimate, came to $384 a car; assembling would add $20; and sales costs (that is, advertising, salaries, commissions, and incidentals) would not exceed $150, bringing the total to $554 without a rear seat tonneau. Addition of a tonneau would raise the cost to $604. In trade papers the exuberant Malcomson had been advertising "the Fordmobile," made by "the Fordmobile Company, Ltd."—neither of which ever came into existence.[39] He and Ford were planning to sell

[illegible] that he was
a [illegible] in earlier
d[illegible] se patents.
C. [illegible] Trade in
Detroit.

the car at $750 in runabout form, and at $850 with tonneau, which would yield a margin of $196 on the smaller size, $246 on the larger. Anderson assured his father that even if $46 were thrown off for unexpected contingencies, the gains would run at least $150 and $200.

On the season's output of 650 cars, this would mean a total profit of nearly a hundred thousand if all buyers took the runabout, and proportionately more if some asked for tonneaus—as most of them probably would. Anderson did not see how the venture could fail:

> Now, the demand for automobiles is a perfect craze. Every factory here (there are 3 including the Olds—the largest in the country—and you know Detroit is the largest automobile center in the United States) has its entire output sold and cannot begin to fill their orders. Mr. Malcomson has already begun to be deluged with orders, although not a machine has been put on the market and will not be until July 1st. Buyers have heard of it and go out to Dodge Brothers and inspect it, test it, and give their orders. One dealer from Buffalo was here last week and ordered twenty-five, three were ordered today, and other orders have begun to come in every day, so there is not the slightest doubt as to the market or the demand. And it is all spot cash on delivery, and no guarantee or string attached of any kind. . . .
>
> Mr. James Couzens is going to leave the coal business, for the present at least, and devote his entire time to the office end and management of the automobile business—and he is a crackerjack. He is going to invest, as he expresses it, "all the money he can beg, borrow, or steal" in stock.

4.

On June 16, 1903, papers of incorporation for the Ford Motor Company (the name was proposed by Malcomson at a stockholders' meeting on the previous day) were filed at the state capitol in Lansing; and two days later Ford & Malcomson, Ltd., transferred all their holdings —machinery, tools, appliances, plans, specifications, blueprints, patents —to the company for 510 shares, to be divided equally between the partners. In asset statements a short time later the machinery was valued at $10,000, and the patents at $40,000, a highly artificial estimate.[40] The thousand shares of the company, representing nominally $100,000,* were divided among twelve investors in the following fashion:

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* The Ford Motor Company was nominally capitalized at $150,000; but only $100,000 in stock was issued, the remaining $50,000 being held as treasury stock.

At the beginning of July, the Dodge works began to deliver what the contract called the running-gear; that is, the motors, frames, transmissions, and axles, ready for the attachment of wheels and bodies. They were brought from the Monroe Street plant on hayracks drawn by horses, dumped in one of twelve or fifteen designated spots on the floor, and given a "running inspection;" that is, the motor was tuned up, the carburetor was adjusted, the valves and transmission-bands were tested, and the brakes were put in working shape.[44] If all this was satisfactory, the other parts were brought up for assembly. The small working force dealt with four cars in a group. When they were finished, it moved to another group of four. Usually two or three men worked on each car.

"We used to try to get out fifteen cars a day," recalls one worker. "We would work our hearts out to get out fifteen a day." First the wheels went on; next the body, so light that two men could lift it; and then the fenders. Finally they gave the car a careful test, and painted it. While the first crop of 650 cars was being assembled and shipped out, a second story was put on the factory for a paint shop and other uses.

But for a few weeks at the start the company ran a neck-and-neck race with bankruptcy. On June 26, with a bank balance of $14,500, it had to disburse $10,000 to Malcomson to cover payments made by him to the Dodge Brothers; $5000 to the Dodge Brothers for engines; $640 to the Hartford Rubber Works for sixty-four tires; and some smaller sums. This would have left the company account overdrawn but for the fact that on the same day J. W. Anderson paid in his $5000. Five days later payments for salaries and services had to be made to Ford, Couzens, Wills, Gould, Wandersee, and others; and between July 7 and July 11, a payment of $5000 to Dodge Brothers and checks for rent and other expenses brought the balance down to $223.65. The company was skirting the edge of ruin! As yet not a car had been sold; unpaid bills were mounting; the suppliers of parts were growing clamorous. Happily, Malcomson and Ford were able to bring pressure to bear on Albert Strelow, whose stock subscription was not yet covered. On the 11th his check for $5000 arrived—and loud must have been the sighs of relief.

Then, in the nick of time, came the first orders. On July 15 Couzens was able to bank a check from Dr. E. Pfennig for $850, drawn on a

Chicago bank. It is interesting to note that this initial buyer was a physician; as a group, doctors were among the first to make significant use of the automobile. Within the next week came payments of $300 from the Indiana Auto Company of Indianapolis, $300 from the Ohio Motor Car Company, $300 from the Kentucky Auto Company, $650 from a Dr. H. W. Yates (we do not know his address), and $170 from H. L. McNary of Chicago. Ford and his partners had turned the corner. They were able to pay the Dodge Brothers another $5,000 on July 24, and still have a bank balance on August 1 of $3,831.77. Thereafter a fairly steady stream of orders flowed in, with the gratifying result that on August 20 the company had a balance of $23,060.67. (All these facts and figures are drawn from its first checkbook, with entries in Couzens's handwriting.) It had won its breathless race.[45]

The Model A, though crude in comparison with the cars which followed it during the next eight years, had the great merits of simplicity, lightness, and efficiency. Doubtless the design had been guided to its final form by Ford himself, though Barthel may have made a contribution, and Wills unquestionably played a vital role in the development of the car.[46] Its main features certainly conformed to principles that Ford always championed. He constantly denied that weight had any relation to strength, and inveighed against heavy automobiles on the roads and heavy locomotives on the railways. "The car that I designed was lighter than any car that had yet been made," he later declared. "It would have been lighter had I known how to make it so."[47] The completed runabout weighed only 1250 pounds.

Its principal claim to novelty lay in its two-cylinder opposed engine, which developed eight horsepower and on good roads could bring the speed up to thirty miles an hour. The wheel base measured just six feet. As in other cars of the period, the steering wheel was on the right. The driver opened no door to get in, but simply slid into his seat, his whole body in full view. The car had no running board and stood high above the street; the passenger therefore groped with his foot for a small, sharp, and in wet weather slippery carriage step. The transmission, then often called the "change-gear," was of the planetary type, with two speeds forward and one reverse.[48] Both the ignition and the throttle were adjusted by hand, the former getting its spark from two sets of six dry-cell batteries. The tonneau or backseat attachment was slipped on and off from the rear.

As production began, the company spared a little money to broaden its advertising. Malcomson, Couzens, and Ford all took a critical interest in publicity and agreed upon the main terms of their appeal. It was in keeping with the character of all three that they emphasized utility, not pleasure. Their car, they announced, was for everyday wear and tear in business, professional, and family use. Compact, simple, safe, it would furnish reasonable speed but not "any of those breakneck velocities which are so universally condemned." The advertisements boasted of the strong materials, efficient engine, automatic oiling, and sound workmanship:[49]

> Always ready, always sure.
> Built to save you time and consequent money.
> Built to take you anywhere you want to go and back again on time.
> Built to add to your reputation for punctuality; to keep your customers good-humored and in a buying mood.
> Built for business or pleasure—just as you say.

And one chord was struck heavily in all the advertisements—cheapness: "Its exceedingly reasonable price, which places it within the reach of many thousands who could not think of paying the comparatively fabulous prices asked for most machines." According to Wandersee, Ford from the outset wished to build a car for $500.

All spring Ford and Couzens had worked like galley-slaves to make ready; all summer and fall they labored with the frenzy of harvest-hands racing a storm—for they had to assemble and market the 650 cars in time to pay their suppliers. The five directors chosen in June (Gray, Malcomson, Ford, John F. Dodge, and Anderson) immediately fixed Ford's salary at $3600 a year, and that of Couzens at $2500.[50] A week later they appointed Charles Wardle of Chicago sales manager at $208.33 a month, with travelling expenses.[51] Wardle seems to have been a disappointment, for he was dropped in the fall.[52] Ford and Couzens, however, earned their salaries by tireless labors that sometimes ran to twelve or sixteen hours daily for seven days a week. The original idea that Malcomson should act as manager had to be given up because he was head-over-ears in his expanding coal business. When Gray was elected president, Henry Ford was made vice-president, Malcomson treasurer, and Couzens secretary. Actually Ford was the effective president, and Couzens did the work of treasurer as well as

secretary. Success depended on these two men, and they rose to the challenge.

From the outset Ford was in charge of production, Couzens of business affairs. On the factory floor Ford was supreme; in the offices Couzens oversaw the bookkeeping, wrote letters, paid bills, collected moneys due, and after mid-November supervised sales. It was Couzens who drew up the first annual statement.[53] Ford had the final word on all matters of automobile design and engineering; when opinions differed, he said, "We shall do it this way"—and it was so done. He spent practically all his time in the plant, wearing an ordinary business suit, but never hesitating at need to take off his coat and tackle the dirtiest piece of work alongside the mechanics.[54] Couzens rapidly assumed the authority to meet his expanding responsibilities. He was in charge of advertising; he was soon authorized to make all contracts with the growing network of sales agencies; he was given the task of negotiating with Dodge Brothers and the other parts-makers the cost of making improvements on the 1904 model. It was in recognition of hard work well done that in the fall of 1903 his salary was raised to $3000 a year.[55]

A special note upon Couzens is required. The partner who was to work closely and prodigiously with Henry Ford for the next twelve years was a blond, stocky, belligerent-looking young man who had been born in Canada in 1872, son of an English grocery clerk who later became the owner of a small soap-factory in Chatham, Ontario. From childhood Couzens had shown determination, a precise and almost furious industry, a hot temper, and a determination to succeed. As a youth he reproached his mother for letting him be born in Canada. "I can never become King of England," he said sharply and quite seriously, "but if I had been born in the United States, I could be President." He resented the fact that he had been named after his father, and as a gesture of independence soon shed his middle name, Joseph.

A street-lighter and newsboy after school, young Couzens was enterprising enough at the age of twelve to obtain a position of bookkeeper; and when discharged because of his youth, he prepared diligently at high school and outside to take up the very work at which he had failed, resolved to excel in it. Clashing with his father, at whose soap factory he worked for a time, he came to Detroit when not quite eighteen, got a job as car-checker for the Michigan Central, and after a

time demanded and received the position of director of the freight office. He was an unpopular boss, but respected for his competence, aggressiveness, and working capacity. When he quarreled with a superintendent and was told that he was discharged, he snapped: "You can't fire me!" which proved to be the fact. Couzens sympathized with the workers in the famous Pullman strike, was a single-taxer "in principle," and in general showed a bristling resentment of oppressive employers. But as the representative of the railroad he treated protesting shippers roughly, cuffing them down with relish. One of these was Malcomson, who watched the able, pugnacious clerk with a grudging admiration and concluded that so stiff and assiduous an employee would be valuable to him. When he offered a job, Couzens filled it admirably, although the two often quarreled.

Couzens had married Margaret Manning, an attractive, practical girl of good family who was a Roman Catholic. (This horrified the senior Couzens, a Presbyterian elder, but the son grimly told him to mind his own business.) After four years, the Couzenses, a devoted couple, had two sons.

Naturally, Ford and Couzens regarded themselves as insiders, and Gray, Malcomson, and the rest as outsiders. This was made plain when Ford, driving Couzens home after the pre-organizational meeting, brought up the question of salaries, demanding: "What do you think we ought to ask from *those fellows?*"[58] So distinct were the spheres of the men that at the beginning they never clashed. That each was a powerful individualist, however, was patent to all. The dogmatic, precise, hard-fisted, irascible Couzens, whose fits of temper soon became notorious, kept subordinates in awe. "He was a manhandler," records one early employee. "We went in enthusiastically and he opened up the hydrant on us and chilled us off." His sturdy, John Bullish figure, buttoned into a tight jacket, his square jaw, firmly-closed lips, steely eyes, and bulging forehead, exhaled energy, vigilance, and severity. Ford, too, was in a different way a manhandler. At this period he was one of the boys, always ready with a joke or backslap as he moved among the hands, but he expected obedience on the jump. Arriving at the Mack Avenue doors by seven and toiling often till eleven, the two drove the force with steady speed.

Frank Bennett, a mechanic who went to work for the company on Easter Monday in 1904, gives us a picture of the hardworking little

establishment that spring and summer. It now occupied a two-story building of which the first floor was entirely open—no partitions; Couzens's office on the second floor was of unpainted lumber. Four cars, as we have seen, were put together at once, the parts being brought up to the frames. The whole working force averaged about forty. On the first floor a blacksmith shop was operated by Andrew Kulick, father of Frank; on the second a maintenance room with spare parts used in repair work was under the charge of a burly, stodgy French Canadian named P. E. Martin, who also came in the spring of 1904. Bennett's initial job was putting on the front fenders—"You could wear them for a luck charm, they were so small," he said. As an unskilled laborer, he at first worked a nine or ten hour day for $1.50; then, as he did well, they told him, "We're going to give you $1.75." A new foreman, Al Andrich, had come in on the recommendation of Dodge Brothers. The shop had little in the way of tools and machines, for as yet little was needed.

Ford, Wills, and their assistants were busy most of the time in the experimental room which extended across the whole rear end of the building on the first floor. A rough pine partition shut them off from the noisy shop, and another divided their machines—shaper, drill, lathes, and so on—from the drafting room. Besides the two chiefs and Andrich, only Gus Degener, John Wandersee, Harry Love, and Fred Seeman were allowed keys, for the designing of new models and parts went on there. Ford was frequently at work before eight, and came back after supper. He was "an agile, friendly man," Seeman recalls; "a man that nobody need be afraid to approach at all." He occasionally brought young George Holley with him. "Sometimes they'd have a discussion, and the first thing you knew, they'd both be on the floor wrestling." Nothing made Ford happier than to electrify a doorknob so as to give some co-worker an unexpected shock, or to nail down a hat.[57]

In business matters Couzens sometimes enforced his will against Malcomson and Ford. When he took over the sales managership, for example, he made a rule that discounts should be granted only to agencies, never to individuals. A month later he learned that Malcomson had allowed a friend a discount on a car. The angry Couzens scolded with such heat that Malcomson paid the difference and promised never to err again.[58] More important was Couzens's firm stand

when in the early summer of 1903 Ford threatened to let his old perfectionism endanger the company as it had his earlier ventures. "The cars are not yet good enough," he said in effect. "We can make them better." Couzens said they *were* good enough. Determined to bring some money into their dwindling bank account, he helped Ford and Wills crate the machines, take them to the railway station, and seal the train doors.[59] Then he brushed his derby and hurried to the bank to draw sight drafts on the Indiana and Minnesota purchasers.[60] It was by no means the last time that he was to make Ford toe the line in meeting market demand.

It was on this very occasion, or on a similar one a few days later, as Ford and Couzens were putting Model A's into freight cars, that someone brought them a Detroit paper containing an advertisement signed by the Association of Licensed Automobile Manufacturers. This warned the public that nobody was entitled to sell, buy, or use a car not licensed under the patent of George B. Selden. As we have seen, Ford had for some time been cognizant of the activities of this Rochester attorney, and both he and Couzens knew about the A. L. A. M., of which a number of Detroit automobile firms—Olds, Packard, Cadillac, Northern, for example—were members. The other stockholders were also acquainted with this organization. The Ford officials, realizing that at the very birth of their company the A. L. A. M. threatened its existence, were undaunted, although a fuller knowledge of the facts might have made them less bold. Ford and Couzens went on with their work; however, they made the Selden threat a subject for prompt conference, and we shall see that action upon the threat was soon taken.

Happily, the demand for cars was keen. In the first nine and a half months, from mid-June, 1903, to the end of March, 1904, the company sold 658 automobiles, for a total of $354,190, with a net profit of $98,851.[61] This did not include the three best months of 1904, April, May, and June, during which sales reached almost $650,000.* The whole number of cars made and sold in the first fifteen months came to 1700. From the start the company was able to finance itself by revenues; its receipts from sales in October, 1903, for example, were $62,207; in November, $52,495; and in December $67,754.[62]

"The business went along almost as by magic," wrote Ford later.

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* It should be said, however, that Couzens' bookkeeping was somewhat primitive, and that he took no due account of depreciation. When later the expert accountant Norval Hawkins was called in as auditor, he was horrified by the crude character of the balance sheets.

"The cars gained a reputation for standing up." This was far from being the fact; the business had ups and downs, and the early cars provoked vehement fault-finding. Many of the defects were the fault of the Dodge Brothers, whose system of paying employees by the piece resulted in much hasty, botched work.

Ford's tester in these early days, a mechanic named Fred Rockelman, once went to the Dodge shop to expostulate. Hot words were exchanged, and John Dodge, always tough, grim, and fiery-tempered, finally came forward with doubled fists threatening to toss Rockelman out the door. "Throw me out!" blazed Rockelman. "That doesn't mean that we will accept your engines with loose fly-wheels!" They challenged him to prove that the flywheels were loose. He strode up to a motor, took the two-cylinder crankshaft, and jammed it into the flywheel by hand. At this they apologized and promised to do better.[63] Ford laughed when he heard of the incident: "Oh, those Dodge brothers' bark is worse than their bite," he said. But the Ford Company insisted on large deductions for bad motors.

"This new, light touring car fills the demand for an automobile between a runabout and a heavy touring car," asserted an early advertisement. "It is positively the most perfect machine on the market, having overcome all drawbacks such as smell, noise, jolt, etc., common to all other makes of auto carriages."[64] The engine design was in some ways really superior to that of other medium-priced cars; indeed, in 1903, no other two-cylinder engine seems to have been made for a runabout.[65]

A great many faults, however, had to be eliminated. The radiators were so defective that the engine grew hot and the water boiled even in high gear on a level road. "We have sold thirty-five machines on which the radiating capacity is not sufficient," grumbled a Los Angeles dealer, "and whatever is done to cure this trouble will have to be done for these thirty-five machines."[66] The Kingston carburetors, as we have noted, proved inefficient, and the Schebler carburetors first used to replace them were still mediocre. Only the new carburetor made by Holley, embodying some principles laid down by Wills and Ford, solved that problem.[67] The brakes in the original Model A were good if assembled with great care; unfortunately, many were hastily put together by the Dodges. Dealers then had to take the rear axle to pieces and remove the brake bands to get at the trouble.[68]

For a time, in fact, nearly everything seemed wrong with these first cars.* The splash oiling system made excessive use of oil. The circulating pump was inefficient. The spark plugs became dirty because oil leaked past the piston-rings. The transmissions provoked complaint, for the bands slipped. The chain-drive grew troublesome as soon as the chains, which were of the bicycle type, became worn.[69] When the car was cranked without a cautious retarding of the spark, the motor often caused the crank to kick back like an Alabama mule, breaking the driver's arm or injuring the machine.[70] The Los Angeles dealer shortly sent in a long list of changes which he earnestly recommended.[71] They included:

> Make brakes more sensitive and powerful by shortening adjusting eye-bolt.
> See that lubricator glasses have large enough hole.
> Put in Schebler carburetor.
> Get the valve in the gas tank out of the way of carburetor.
> Make strut rod end adjustable for wear [the struts rattled].
> Put battery terminals outside battery box.
> Front wheels turn wrong. Steering knuckles should be bent differently.
> Radiator too small; more radiator tubes needed.
> Steering rod eye-bolt wears out too quickly.
> Cast iron in which spark plug is screwed in is too long.
> Pins in steering wheel should be upset at each end.

Such were the difficulties of car manufacturing in those primitive days! The dealer was called east to confer with Ford. Most of the adjustments he advised were easily made, and he soon admitted that "changing the carburetor alone has made nearly all our worst kickers perfectly satisfied."[72] When Ford found that the light cast iron brake

[illegible] industry, [illegible] lefective. [illegible] he buyer [illegible] r, and a [illegible] n season [illegible] ght in a [illegible] ould not let the car be sold with the bad part without ruining its reputation. But as yet the Ford Motor Company was safe.

[illegible] bought one of the earliest [illegible] isis: "I got one [illegible] as good as his [illegible] plant in Detroit, [illegible] ter than others, [illegible] his advertising [illegible] ovember, 1937.

drums on the Model A broke easily, he changed to malleable iron. The oiling mechanism, which one of the principal Eastern dealers called the worst on any car he knew, was improved.[73] After six months of tinkering and readjustment, the Model A was in fact almost reborn.*

5.

Many of the first automobile dealers were men related to the old vehicle trades: bicycle merchants, wagon builders, keepers of livery stables or harness shops, tire dealers, and blacksmiths skilled in vehicle repairs. They knew little of internal combustion engines, and could not repair cars until instructed. In the Detroit area the problem was easily solved. "Whenever the road men came in with complaints," a Ford employee recalls, "Mr. Couzens would have us right out to right it. Then Mr. Wills or Mr. Ford would okay what we had done, and we would send out letters to the dealers telling them what to look for." He adds a statement significant both of the state of the industry and of Ford's attitude:

> Mr. Ford was always a great believer in service. He always said that a car was never complete, that it was 75 per cent complete when it left the factory and 25 per cent of the completion was done by the dealers. It needed gasoline, it needed tires, it needed tire repairs, it needed washing, and it needed tuning up. . . . A Ford car as manufactured plus dealers' service made it 100 per cent in the hands of the public. Mr. Ford from the very early days pressed that the dealers should be able to give service to their cars. That was uppermost in his mind constantly.[74]

At a directors' meeting on June 20, 1904, Ford and Dodge put through a resolution that mechanics be employed to visit agencies, instruct them on the machines, and help them deal with crippled cars.[75] One such mechanic spent much time on the road in 1904, finding some dealers who spoke of the Ford car in sulphurous terms, and bringing them into good humor.[76]

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* Dealers were not the only ones to complain about the car. On April 13, 1904, Peter S. [illegible]

Hyatt [illegible] second letter enlarging on the injury Ford had done [illegible] *tned* that Ford would use his bearings. "My stock [illegible] Ford Office Files, Ford Archives.) The immediate [illegible] was soon using Hyatt bearings.

It is evidence of the general merit of Model A that Couzens quickly enlisted a considerable body of dealers. During 1903 the New York agency was the Duerr-Ward Company. When 1904 opened, the directors transferred their contracts to John Wanamaker, who first established temporary salesrooms on East 37th Street and later found better quarters on Broadway between 49th and 50th. Wanamaker also undertook the agency in Philadelphia. In Chicago, McCord & Company were the initial agents.[77] The Los Angeles Automobile Company covered southern California. As the months passed contracts were made by Couzens with dealers in nearly every great city. At first Detroit buyers went direct to the factory; but near the end of March, 1904, the company opened a handsomely appointed salesroom at 234 Jefferson Avenue, with premises roomy enough (200 by 60 feet) for an office, storage room, and repair shop. Charles A. Grant, well known in motor circles, was put in charge.[78] The car soon began to find foreign buyers; a shipment was made to Honolulu in the early fall of 1903, and on October 24 the directors authorized a contract with R. M. Lockwood of New York as their representative in all foreign business.[79] Not only the United States, but the whole world, was awakening to a hunger for automobiles.

From the beginning the company made profits that were large in proportion to the capital invested. Couzens on October 1, 1903, wrote John W. Anderson that on the first three and a half months' operations they had made a profit of $36,957, that they had $16,186 in hand, and that about $15,000 more was due them in bills receivable.[80] On November 21 the company felt able to pay a ten per cent dividend. In sixty working days (July 23–September 30, 1903) 215 cars had been assembled, and 195 had been shipped. The average cost of assembling had been held to $36.75, and the average office, advertising and sales expense to $31.18 per machine. It was an encouraging fact that 159 of these 195 initial cars were equipped with tonneaus, for this decidedly raised the average profit.

The next balance sheet, covering nine and a half months' business, revealed (as we have already noted) earnings of nearly $100,000. This profit was almost precisely that which Anderson, in borrowing money from his father for his investment, had predicted on the first 650 machines. Various items (including the writing down of over-valued patents and machinery, the elimination of bad debts, and an additional

twenty per cent dividend) lowered the surplus of $61,994; while Couzens proposed that the whole $40,000 debit carried for patents be reduced as fast as possible.[81] All in all, the outlook for the future was exceedingly hopeful. Ford had a good car; he could rapidly make better ones; Couzens had proved a highly exceptional talent for business; and the demand was barely tapped. The stockholders by Christmas of 1903 felt that fortune lay just ahead.

The steady demand encouraged the directors, as we have seen, to ask Strelow to add a second story to the Mack Avenue Plant; they advanced $5000 for this purpose, and agreed to pay the increased taxes and insurance.[82] It encouraged them to contract with Dodge Brothers in October, 1903, for the delivery of 755 more engines in the first five months of the next year, with the right to order 500 additional by April 1. Motors were to be delivered at the rate of five, six, and seven daily as the season advanced, at $265 apiece, the Ford Company supplying spark plugs and spark coils. The force of mechanics was rapidly augmented; and the pace of the assembling was raised until the shop became one of the busiest places in Detroit, full of hurry, clangor, and the blue fumes of exhausts. In May, 1904, the record number of 299 cars were put through their tests, and in June 364 were made.

The heads of the company at the end of their first season could look back on a dramatically flying start. But troublesome problems lay plain on the horizon: problems of plant expansion, for with continued success the Mack Avenue quarters would become utterly inadequate; problems of marketing, for more agencies, with proper standards of operation, must be established; problems of car design, with the growing conflict between Malcomson as advocate of a rather expensive car and Ford as champion of the "family horse;" the problem of a grim threat of legal difficulties over patent rights, with which we shall later deal at length; and a problem of company organization, which in no long time was to produce a sharp crisis.

XII

A BATTLE FOR THE CHEAP CAR

In 1904 Theodore Roosevelt was elected to his second term. During that year and the next—years in which the Panama Canal was begun, the Russo-Japanese War fought, and a vigorous program of domestic reform advanced—the United States enjoyed a radiant prosperity. Business men, labor, farmers, and professional people shared the exhilaration brought by increasing production, rising incomes, and a bettering standard of living. Never before in our history had technology and invention made such large contributions to comfort and convenience: the telephone, the electric light, the bicycle, the phonograph, the gas cooking range, and modern plumbing were becoming familiar to most of the population. Factories were lowering their costs. Between 1901 and 1913, the ton-mileage of the railroads practically doubled. Close students of economic tendencies saw that one element in giving Americans a more bountiful cornucopia of plenty was a striking change in the form and structure of industry. Three ideas that went back to James Watt and Eli Whitney, the ideas of standardization, simplification, and interchangeability, were being applied as never before to yield in quantity production of machine goods. Various new manufactures in the United States had now been conducted for years as quantity production enterprises: telephone sets, bicycles, typewriters, and cash registers among them.[1]

By 1904 the automobile industry, though still small, was making such progress that many predicted for it a dazzling future. In January the Automobile Show in New York drew throngs to Madison Square Garden. The Detroit cars shown included the Cadillac, Olds, Ford, Packard, Northern and Wolverine, and one reporter estimated that of

about twelve thousand cars sold, half were ordered from Detroit.[2] The Chicago and Philadelphia shows were equally successful. In Detroit, where an automobile show, sports show, and dog show were held at the same time and place, from one thousand to four thousand people daily came through the February cold to see the new models. "Henry Ford," remarked the Detroit *Journal* of the opening, "with his exhibition of Ford machines, was a pretty popular man during the afternoon and evening;"[3] and Couzens was equally in evidence. Inasmuch as dealers flocked to these shows, Couzens attended as many as possible (for they were held in such smaller places as Boston, Indianapolis, and San Francisco) to enlist new agents. When the Louisiana Purchase Exposition opened this Spring in St. Louis, the Ford Company had an exhibit with clerks and leaflets to explain the three new models.[4]

Early in the year numerous manufacturers, inundated with orders, hired additional batches of men and began working their assembly floors in two shifts.[5] Some experts prophesied a wild demand for anything that could run. Five years previously the number of American establishments making motor vehicles had been 57, with 2,241 wage-earners and a product valued at less than $4,750,000. Now in 1904 the number of establishments was 178, with more than 12,000 workers, and a product valued at more than thirty millions. To these might be added nearly 60 companies specializing in bodies and parts, with more than 1800 wage-earners and a product worth about four millions. Michigan had its full share of them. When the Gray Manufacturing Company began making mufflers in Detroit early in 1905, it announced that it had chosen the city because it was the center of the nation's automobile industry.

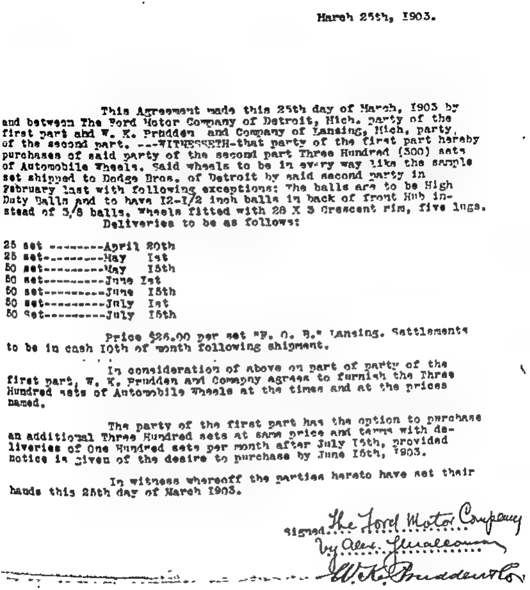
In Detroit the boom in motor manufacture was a theme of exultation among many business men: hardware dealers, specialty manufacturers, ironmasters, real estate interests, and builders. Newspapers joyously hymned it, and ministers even referred to it from the pulpit. Henry Ford remarked that the New York Automobile Show ought really to be called the Detroit Show—for Detroit had more cars than any half dozen other American cities. "Predict Auto Famine," ran a headline in the Detroit *Journal* for February 11, 1905. "Manufacturers are swamped with orders," reported the paper. "Eight Thousand Men Build Autos" ran another headline for July 25, 1905. The city, declared the article, had fourteen companies assembling automobiles, two man-

2.

A popular slogan with dealers at this time ran: "There's nothing to watch but the road!" Doubtless it helped to sell cars, but it had an unintentional double meaning, for there were still few roads in the United States so good that the driver did not need to watch them for his safety. As the dynamic Albert A. Pope had only recently declared: "The American who buys an automobile finds himself with this great difficulty: he has nowhere to use it. He must pick and choose between bad roads and worse."[17]

This was the fact despite the existence of an active American good roads movement for almost a quarter of a century. As early in 1880 the League of American Wheelmen, organizing at Newport, R. I., had announced among its purposes the promotion of "the improvement of public roads and highways."[18] Some ferment of opinion must have preceded this declaration, and Colonel Pope, who had launched the American bicycle industry two years earlier, was certainly a contributor to that ferment. He had been quick to realize that the bicyclist needed a variety of services, among them the establishment of his legal status, the improvement of streets and highways, and the construction of special paths along the roads on which he might ride without interfering with or being subject to interference from horse-drawn traffic. For decades Pope lectured, wrote, organized, and lobbied for better thoroughfares; his companies and his friends enlisted under the standard he raised; and the aid he extended to periodicals like *Bicycle World*, *Wheel*, and *Wheelman* (later *Outing*) had an indirect effect in furthering the movement. He was an influence in bringing about the founding of *Good Roads Magazine* by the League of American Wheelmen in 1892 (later to become the *L. A. W. Bulletin & Good Roads*), and he assisted in promoting the League's monster petition to Congress for federal action in the same year, which brought into being in 1893 the Office of Road Inquiry in the United States Department of Agriculture.[19] This agency had a pitiful budget of only $10,000, but it marked the re-entry of the federal government into the road-building scene, which it had abandoned in 1837 with the panic of that year and the rapid growth of railroads.[20]

Pope was of course only one of many workers, and a few men like General Roy Stone of New York were comparable with him in energy



March 25th, I903.

This Agreement made this 25th day of March, I903 by and between The Ford Motor Company of Detroit, Mich. party of the first part and W. K. Prudden and Company of Lansing, Mich. party, of the second part. ---WITNESSETH-that party of the first part hereby purchases of said party of the second part Three Hundred (300) sets of Automobile Wheels. Said wheels to be in every way like the sample set shipped to Dodge Bros. of Detroit by said second party in February last with following exceptions: The balls are to be High Duty Balls and to have I2-I/2 inch balls in back of front Hub instead of 3/8 balls. Wheels fitted with 28 X 3 Crescent rim, five lugs.

Deliveries to be as follows:

25 set ---------April 20th
25 set----------May Ist
50 set----------May I5th
50 set----------June Ist
50 set----------June I5th
50 set----------July Ist
50 Set----------July I5th

Price $26.00 per set "F. O. B." Lansing. Settlements to be in cash I0th of month following shipment.

In consideration of above on part of party of the first part, W. K. Prudden and Company agrees to furnish the Three Hundred sets of Automobile Wheels at the times and at the prices named.

The party of the first part has the option to purchase an additional Three Hundred sets at same price and terms with deliveries of One Hundred sets per month after July I5th, provided notice is given of the desire to purchase by June I5th, I903.

In witness whereoff the parties hereto have set their hands this 25th day of March I903.

Signed The Ford Motor Company
by Alex. Malcomson
W. K. Prudden Co

Tires, at four for $26. One of the first contracts with a supplier of parts, 1903

2.

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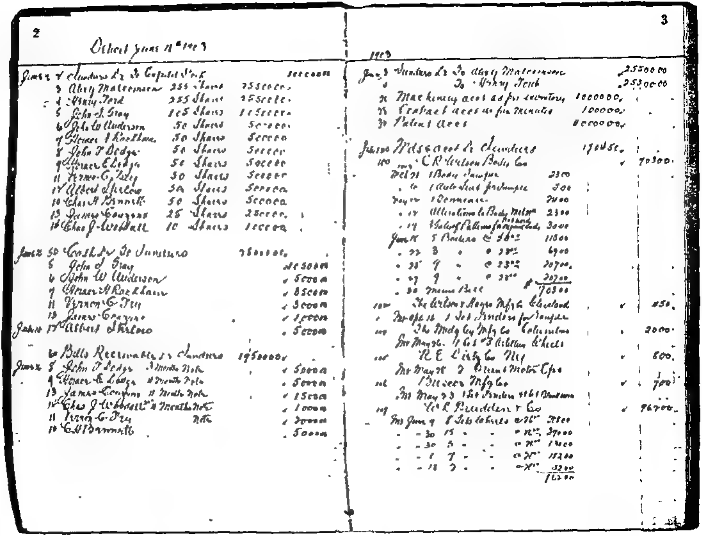
John S. Gray, banker and partner in the Ford Motor Company

Employees at the Mack Avenue Plant in 1903 or 1904



he Company accounts in
une and July, 1903

and influence. Stone organized the National League for Good Roads, which by 1893 had branches in most states of the union.[21] However, the movement faced conditions so dismal that its early energies went into laying the foundations for future work. Education was essential, and much effort was spent in convincing the public that good roads would pay. The farmer, for example, had to be shown that bad roads were a tragic handicap to him; government figures were cited to prove that while it cost a British or German landholder only seven to nine cents to haul a ton of produce to market, it cost the average American twenty-three cents.[22] Good roads advocates worked also for the abolition of the mediaeval practice of working out road taxes by labor, for the employment of trained engineers instead of elected officials to supervise road construction, and for the planned action of city, county, state, and federal government in attacking the problem. In addition, the movement faced not merely a need for improvement, but rather the necessity of building a wholly new system of roads. For wretched thoroughfares were a shameful fact even in most of the great cities of the land, where a large proportion of streets were in miserable condition, and were far worse in rural regions, where residents, except those at ports or railroad stations, were mostly served by tracks that were mud in wet weather and dust-troughs in dry.

Of course a few respectable highways had existed even in the eighteenth century, and as we have seen, the turnpikes of the early 1800's had added to the mileage; and fortunately construction, which had languished for a time after the 1830's, had begun to revive just before the Civil War. Macadamizing and telfordizing were practised to some extent, and in 1858 Eli Whitney Blake had produced the jaw rock-crusher.[23] After the war, as Portland cement began to be made in America (1871), as steam-rollers and horse-drawn scrapers came into use, and as increasing settlement forced the problem of better transportation upon public-spirited officials, a small though steady activity developed.* Pope and his fellow-crusaders came at a strategic time, and as they pushed their cause road-building went forward at an accelerated pace. The role of the states was a highly important factor. New Jer-

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* Natural cement was used as early as 1820 in building the Erie Canal. Portland cement, first made in England, was long neglected in America because of the abundance of natural cement rock. When introduced, it was given limited used in driveways, culverts, and drains, slowly but steadily gaining favor 1875–1900. See *Cement and Concrete Reference Book* (Portland Cement Association, 1948).

sey led in action that established modern practices: in 1888 its legislature abolished the road overseer system and ordered all road taxes to be paid in cash, and in 1891 passed a state aid law, effective the following year, sanctioning a plan for financing highways which involved contributions by property holders and by township, county, and state governments. Massachusetts and Vermont enacted comparable legislation in 1892; Connecticut and California in 1895; Maryland and New York in 1898. Maine, Rhode Island, New Hampshire, and Pennsylvania soon followed, and between 1904 and 1913 sixteen additional states were to act.[24]

Results were soon visible: the nation began to pull itself out of the mud and dust. Yet in 1904, when the Office of Public Roads (successor to the Office of Road Inquiry, later the Office of Public Road Inquiries) took the first census of American roads, there were only 153,664.3 miles of improved highways (7.14 per cent of the total in the country) and the rest of the 2,151,570 were dirt. Furthermore, of the surfaced roads 108,232.9 were gravel, and only 38,621.7 "stone" (mostly macadam), while 6,809.7 were shell, sand-clay, oil, brick and the like. Thus only one mile of improved road existed for every 492 inhabitants, and much of this was not of durable quality.[25] And unhappily, though this fact had yet to be discovered, even macadamized roads were not fit for steady automobile traffic;* probably only a few hundred miles of highway in the entire country were sturdy enough for the regular use of the new motor cars.

On April 27, 1903, the National Good Roads Convention met at St. Louis, Missouri. With delegates from all parts of the nation, with its president William H. Moore wielding the gavel, with addresses by Governor A. M. Dockery of Missouri, Director Martin Dodge of the Office of Public Road Inquiries, Senator A. C. Latimer, General Nelson

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* Laurence I. Hewes in the Office of Public Roads Bulletin No. 48, *Repair and Maintenance of Highways*, 1913, stated: "It is now demonstrated beyond doubt that an ordinary water-bound macadam cannot successfully stand the action of a considerable amount of automobile traffic." Such traffic disturbed the "binder" and made the road "ravel." It may be explained that the type of road known as macadam or macadamized was developed by the Scottish engineer John Loudon MacAdam (1756–1836) and was constructed by establishing a crowned earth foundation, thoroughly drained, on which broken rock was laid, topped in later practice by smaller rock which was filled in with gravel and rock dust. This was then rolled. Water (some times merely the action of rain) was the only binder (hence "water-bound"), tending to solidify the surface as it was used by traffic. Later, in the effort to hold the binder under heavier traffic, asphalt and other substances [illegible] (1757–1834), required a base [illegible] employed for the macadamized [illegible] which began with a base of f[illegible] of finer material. For a more [illegible] *[illegible] of the Office of Public R*[illegible] Bulletin No. 47 of the Office, Washington, 1913.

A. Miles, William Jennings Bryan, and President Theodore Roosevelt, the gathering could feel that it had carried the good roads movement to a high point of prestige and the promise of effectiveness. Roosevelt declared that "merely from the standpoint of historical analogy we should have the right to ask that this people which has tamed a continent . . . build good roads." He pointed out that those who assumed "that having good railroads was a substitute for having good highways" were mistaken. "A more untenable position can not be imagined."

The convention proceedings revealed clearly the types of work hitherto done to advance the movement: the construction as "object-lesson" or sample miles of roadway; the work of good roads trains, with speakers, exhibits and often demonstrations; and the work of state authorities, by far the most extensive and impressive. The delegates in a series of resolutions recommended the enlargement of the Office of Public Road Inquiries, endorsed the principle of state aid, and asked federal legislation and appropriations for highway construction. The meeting reveals that the tide of reform was under way, but that the task of making decent roads for the nation was still in its infancy.

With one exception, no speaker mentioned the automobile. The good roads movement was still predominantly a horse-and-buggy and bicycle movement. However, General Roy Stone spoke up emphatically for the importance of the motor carriage. "Since 1892," he asserted, "an entirely new force has appeared in the good roads field and one whose influence can not now be measured or bounded. Already the automobile industry is one of the most most active and powerful in the land, and its representatives fully realize that its ultimate success is bound up with that of road improvement."[26] This statement was surely an exaggeration, for automobile manufacturers and users alike had yet to put their backs into the drive for better highways. Nor had they to date contributed much in taxes on vehicles or gasoline which could be devoted to improving roads. In 1903 New York and Massachusetts were the only states collecting license fees from car owners, and the total they had taken in was $26,865; the ensuing year it had risen to $33,411.[27]

Actually, a greater point of concern than roads with men like Henry Ford was the designing of cars that could negotiate the miserable thoroughfares likely to be encountered. In other words, the majority of automotive men were accepting conditions as they found them. Fortunately that acceptance was not to stand for long.

3.

The Ford Motor Company entered the 1904–05 selling season (that is, the season beginning in autumn and running through the ensuing spring and summer) with a full line of three cars to compete with Olds, Pope, and other manufacturers. The directors had decided that in the field of the light runabout the Model A should give way to the improved Model C, selling at $800 (with tonneau $900). A new touring car, Model F, would be offered at $1000. Both would have Ford's original two-cylinder opposed engine of horizontal type, with his recent improvements; the Model C would weigh 1250 pounds, and the Model F 1400 pounds. In an effort to reach wealthy people, the company would also market a heavier, faster four-cylinder touring car at $2000, which was called the Model B. Ford, Wills, and their assistants had been busy drawing plans and making pilot models. It was plain that the company was moving away from the $500 car, not toward it, and this fact disturbed Ford. He particularly disliked the Model B, upon which Malcomson had insisted. In 1904 the Pope-Hartford was selling for $3200, and the five-passenger Packard, with a four-cylinder twenty-four horsepower engine, was bringing $7000, but Ford distrusted even a $2000 car.

In the midwinter lull—January, 1904—Ford resumed the role of driver in an attempt to set a new speed mark. For if the $2000 car was to be made a success, clearly some spectacular stroke would have to give it a national reputation. Ford therefore announced that he would break the world's speed record with a four-cylinder engine substantially identical with that of Model B. In bitterly cold weather he, Mrs. Ford, and ten-year-old Edsel arrived at Anchor Bay on Lake St. Clair just northeast of Detroit. He had the snow scraped from the ice and the surface for the trials covered with cinders. On Saturday, January 9, he and "Spider" Huff, taking their lives in their hands, whirled and skidded over a four-mile course to make an unofficial time (no representative of the American Automobile Association being present) of 36 seconds for one measured mile.* On the 12th, with official timers on hand, the two repeated the run in 39⅖ seconds, which was still a record.[28] Huff got a $50 bonus!

* The Hotel Chesterfield at New Baltimore near by had advertised the contest by handbills announcing: "The races will start at two o'clock and continue until Mr. Ford lowers the world's record. He proposes to make a mile in 36 seconds!" After the race Ford, Wills, *Huff*, and Wandersee had a muskrat dinner at the hotel.

Ford never forgot the terrors of that run. "The ice seemed smooth enough," he wrote later, "so smooth that if I had called off the trial we should have secured an immense amount of the wrong kind of advertising, but instead of being smooth, the ice was seamed with fissures which I knew were going to mean trouble the moment I got up speed. But there was nothing to do but go through with the trial, so I let the old 'Arrow' out. At every fissure the car leaped into the air. I never knew how it was coming down. When I wasn't in the air, I was skidding, but somehow I stayed top side up and on the course, making a record that went all over the world! That put Model B on the map—but not enough on to overcome the price advances. No stunt and no advertising will sell an article for any length of time."[29]

"Don't Experiment—Just Buy a Ford," ran Couzens's advertising for the season 1904–05. During the spring and summer of 1904 the Mack Avenue plant hummed while dealers, though still grumbling over defects, seized every Model C and F as fast as they came from the assembly floor, and took a satisfactory number of the Model B. All these cars were better than the original Model A. Defects had been partially ironed out. The Model C had ten horsepower and the Model F twelve, against the eight of the first car; they had a larger bore and stroke; their wheelbases were six and twelve inches longer, respectively, while they were 50 to 150 pounds heavier; and they were more attractively painted. The Model B, which with twenty-four horsepower could be pushed to a speed of forty miles, boasted of storage batteries instead of dry cells, of a fifteen-gallon tank, and of a weight of 1700 pounds. All the old Model A's were rapidly closed out. In the fall of 1904 Couzens was able to report total sales for the first year, October 1 to September 30, of just over 1700 cars, for a gross return of $1,162,836.[30] He said later that the Ford cars already "met with less sales resistance" than any others made.[31]

The new 1904–05 season surpassed all expectations. Sales during the autumn were but moderately good averaging a little over $60,000 monthly. Then in March, 1905, they rose above $236,000; in April above $272,000; in May to nearly $330,000; and in June to $356,000.

The importance of these prompt and large returns can hardly be over-estimated. They made it possible to finance a steady expansion of the factory without calling on the banks or Wall Street. Once an automobile company fell into the hands of finance capitalism, danger arose that its policies would be shaped to pay immediate dividends at

the cost of future growth, so as to unload stock on the investing public at excessive prices. Wall Street or State Street directors might try to put nephews and cousins in charge of engineering and purchasing departments. The very fact of a Wall Street connection might bring a company into disrepute, for car-buyers included many business and professional men who were suspicious of high finance.* Of all this Couzens and Ford were keenly aware. Two experts said later that if the Ford Company had been compelled to finance its growth by the sale of preferred stock, it could not have done so on less than an eight per cent basis.[32]

The directors were also able to adopt a generous dividend policy. They had paid $10,000 on November 21, 1903. Then on January 8, 1904, they voted an additional $20,000; and on June 16 a final dividend of $68,000 brought the first year's total to $98,000. The profits distributed had almost equalled the whole capitalization.†

Nevertheless, so extraordinary had been the business record of the company that additional profits were available to plow back into growth. The vision of a massive corporation that not only would compete with Olds, Cadillac, Buick, and others, but tower above them, had already beckoned to Ford and his associates. To fulfill this dream a swift expansion was required and they prepared for it. On April 1, 1904, a special meeting of stockholders approved the purchase of a new site at the junction of Piquette and Beaubien Avenues for $23,500, and the construction of a building at a maximum cost of $76,500.[33] Contracts were let. The site was a lot 430 by 308 feet easily connected with the tracks of the Michigan Central, Lake Shore, Grand Trunk, and other railroads. In May, 1904 foundations were laid, and that summer masons, brickbuilders, and carpenters erected a three-story structure 402 feet long and 56 feet wide. No foundry was provided, and as yet few machine tools were installed, for little manufacture of parts was attempted. Ford and Couzens, confident that they would soon be as-

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* At this early d[illegible] financiers were about as friendly to the automotive in[illegible] fed Detroit manufactory [illegible] by it. Only investors [illegible] ated 1910, Wall Street recognized that the automobile was gaining general acceptance [illegible] large profits—in the right hands.

† A dividend reported by the Detroit *Free Press* of October 16, 1903, was *not* voted on the previous day. Company records show that no action was taken then, but that the dividend of ten per cent on November 21 was to be dated from October 15. The legend that the company returned a full 100 per cent on capitalization in the first year is inaccurate, although the difference in the total figures is slight.

sembling thousands or even tens of thousands of cars every year, should have provided a still larger building.

Their strong financial position enabled them to face with more equanimity than they might otherwise have felt the rapid growth of the cloud that had appeared on the horizon the preceding July. On September 17, 1903, President Gray had asked a meeting of the stockholders for permission to introduce Ralzemond A. Parker of Parker and Burton, patent attorneys, at an adjourned session next day; for the position of the company with respect to the Selden patent and the Association of Licensed Automobile Manufacturers was acute.[34] Parker told the directors that the Selden claims could be successfully fought; and the pugnacious Couzens and stubborn Ford, supported by Gray with his memories of his long legal battle against the glucose interests, resolved to defy the A. L. A. M. They were ready for a dogged contest, and by 1905 were in the midst of it. We shall soon consider that important phase of company history in detail. Meanwhile, the chief concerns of the Ford group were with vital production in the new plant and with distribution.

As sales showed a steady increase, marketing became a complex problem, posing important issues of policy. Selling was still heavily seasonal. Because nearly all cars were open to the weather, and roads were snow-choked or slippery, people in the North did little driving from Thanksgiving till Easter. Steps were being taken, of course, to protect drivers. The dash was being turned into a glass windshield, which could be folded down; automobile tops were becoming more general by 1905. "Those who own topless autos," remarked an official of the Wheeler Manufacturing Company in Detroit, which was working overtime that spring to supply tops, "are recognizing the fact that much of the pleasure is taken away from touring when the occupants are exposed to sun and rain."[35] Side curtains were introduced. Then in time two manufacturers, Fisher and Briggs, developed closed bodies. In these early years, however, few cars were sold from the end of November to the beginning of March, and much of the selling force was then laid off.[36]

By unremitting effort Couzens steadily increased the roster of dependable dealers. While at first anybody with cash enough to pay a deposit on a few cars could represent the company, soon a careful choice was exercised. Discounts or commissions had to be regularized, and

the directors in the fall of 1904 devoted two meetings to the subject. They finally decided that any dealer taking more than a hundred and fifty cars should have a discount of twenty-five per cent at the time of purchase; that anyone taking from fifty to a hundred and fifty should get a discount of twenty per cent and a rebate of five per cent at the expiration of the contract; that for twenty-five to fifty machines the figures should be twenty per cent and three per cent; and that for fifteen to twenty-five cars they should be twenty per cent and two per cent.[37] So keen was the demand that the directors gave warning that they could not guarantee any deliveries. Dealers seldom if ever paid large sums down. The ordinary rule in the trade was that each dealer must pay a small amount, say $100 per car, or in some instances one-tenth of the purchase price, when he signed his contract, and the remainder when delivery was made to him. Every dealer was assigned a certain territory, and the Ford Company soon became vigilant to prevent conflicts of jurisdiction and to stop trespasses.* Couzens, as Sorensen put it later, "was the field dictator."

The threats of the holders of the Selden patent at first did the company little visible harm. To be sure, many dealers refused to handle any cars except those licensed by the Association. In the fall of 1905 at least 1250 dealers were selling various automobiles in the United States, and a year later at least 1545; and of the latter number more than a thousand declined to sell unlicensed machines. Deducting thirty-four dealers who sold steamers and electrics exclusively, the Ford Com-

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car when he sent in his order, but he often got this deposit money from prospective [illegible] Sales were strictly for cash. Cars were sold at the buyers' risk. If they went wrong—why, everybody expected cars in the early days to go wrong. But the situation changed as soon as supply began to catch up with demand. By 1910 a real merchant, with real salesmanship, was needed. Capital began to be required. The busiest selling season was then short, about ninety days in spring. A buyer, with power to shop around, would take only a car on hand. Hence the retailer soon had to have a stock on the floor in the 90-day period; to accumulate cars beforehand. Moreover, many buyers now wished to purchase on credit. This meant that the dealer had to have a long line of bank credit. And finally, buyers began to demand guarantees; if the machine went wrong, they expected repairs, and the replacement of defective parts. Dealers thus had to possess salesmanship, credit standing, and trained mechanics as helpers. The calling of the automobile dealer had become as exacting as it was important.

pany was then restricted to about 450 outlets.[38] But it never met any difficulty in selling all the cars it made, and it was steadily pushing the expansion of its market facilities. In August, 1905, the directors decided to establish "permanent branch stores on the best possible terms" in New York and Philadelphia, and branch agencies in Boston, Buffalo, Chicago, and Kansas City—these taking the place of mere dealers. Next month Gray, Ford, and Couzens were appointed a committee to visit the four last-named cities and Cleveland to carry out this directive. A dealer of course met all his own costs of quarters, staff, and operation; a branch store or agency required capital, but saved the company the large discounts it was granting.

Some of the problems involved in making a choice between dealer representation and the establishment of an agency appear in a report by Couzens to the directors in the summer of 1905 on the situation in Buffalo. He had at first thought that it would be advantageous to plant a branch in that city. Good quarters could be obtained at a reasonable rental, say $2100 a year. Add salaries and incidental charges, and the branch could be maintained for $12,000 a year, which would be only twenty per cent on $60,000 worth of business. "On this basis a profit should accrue to the company from the branch itself, in addition to the many advantages obtainable in taking care of our customers and in promoting sales in surrounding territory." But Couzens had been shaken in his first position by a talk with J. A. Cramer, the regular Buffalo dealer. Cramer was unwilling to give the Ford Company exclusive service. But he was keenly interested in keeping his agency, he made many promises of energetic work and greater courtesy, and he convinced Couzens that he could get more business than anyone else. Already in 1905 he had sold seventy-two Ford cars, for which he had remitted the company about $70,000.[39]

4.

Late in 1904 and early in 1905 manufacturing operations were transferred to the new Piquette Avenue plant. This was "ten times size of present plant," according to a description given in May by the Detroit *Free Press;* and it temporarily provided the entire working force of the Company with a welcome sense of space, with much better floor arrangements for work, and with some improved appliances.

Designed by the architects Field, Hinchman & Smith, the main

building—a power plant, a paint shop, and a testing house stood near it—occupied a site 402 by 56 feet, was three stories in height, and showed careful planning. Stairways at each end led from the ground floor to the second and third, while a large elevator at the rear carried materials. Careful precautions were taken against fire. Each story was divided into four sections by fire walls, and an automatic sprinkling system was fed by a 25,000-gallon tank, with a reserve reservoir of 70,000 gallons.

The business offices occupied a small part of the first floor at the Beaubien and Piquette corner. Here Couzens and Klingensmith had their private quarters, adjoining the bookkeepers, stenographers, and later the sales and advertising personnel. The remainder of the floor was devoted to factory uses. A considerable area was used for testing, although most of this was at first done in the street, and later in the yard.* On the first floor were also a machine shop, an electrical department, and a shipping room.

On the second story, above the business offices, Ford, Wills and others had their quarters, adjoining several experimental rooms. Farther to the rear were the designing and drafting rooms, a second machine shop, and additional space for storage. Later room was made here for assembly work, and body painting and trimming. The third floor in 1904 housed the painting, trimming, and varnishing operations, and the general assembly of cars and storage space. In time the drafting room was shifted to this floor, and a photographic unit for metal analysis was installed. All three floors had storage space.[40]

For the first year, when the production of cars—1745—was little larger than for the 1903–1904 period, the new plant was doubtless roomy. "Ford's immense plant," *Motor Age* hailed it in June, 1904. But it was not "the last word in automobile construction at that time," as one veteran reporter later described it, for the Packard plant was definitely superior and the new Olds works at Lansing were larger, better arranged, and better equipped. And with increasing production the factory soon ceased to be adequate, especially as it was never well-designed for sequential production.[41] The assembly of automobiles was as yet a primitive operation. While the engines, frames, and bodies were assembled separately, with every effort to promote efficiency, they were

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* Frank Hadas, then an employee, describes in his *Reminiscences*, Ford Archives, the testing in the yard. The entire plant area was 1.4 acres.

brought together for final assembly simply by being carried to a designated spot and set on wooden horses, each individual car then being completed by a group of workmen; twelve or fifteen such jobs going on at one time.

That Ford, Wills, and their aides were acutely aware of the disadvantages of this old-style procedure is unquestionable. No continuity of manufacture existed, the order of the work suffering constant interruption.[42] To be sure, an effort was made to preserve a certain neatness; parts were never dumped loose on the floor, but brought up in wooden boxes, while wheels were kept at the side in frames and rolled over as needed. Nevertheless, looking at the unsystematic, cluttered rooms, Ford and his chief associates began to ponder a better arrangement: a plan by which machines, employees, and materials should be placed in a sequential line of production.[43]

"Chief associates" is a phrase which now comprehended quite a large group of men. Harold Wills, aided by C. J. Smith and Harry Love, was still Ford's principal lieutenant in experiment and design. Al Andrich, of the old Mack Street force, had been promoted to be general superintendent of assembly; but he was slack, dissipated, and inefficient, and 1905 found his days numbered. Gus Degener and P. E. Martin had firmly established themselves in Ford's confidence, and the broad-shouldered, sturdy Martin, who had greater force of personality than his jowled face and placid, good natured expression indicated, was being given more and more responsibility. Pattern-making was bossed by the expert mechanic Fred Seeman. As his assistant a young man of powerful body, keen mind, and masterful ways came to the company in the spring of 1905—Charles E. Sorensen. Of Danish birth, he was as tall and handsome as Wills, but more heavily built. With his regular features, thick blonde hair, commanding blue eyes, and abounding vitality, he would have made a matinée idol. Not everyone liked him, for he had fits of grim moodiness and an explosive temper, but all respected his quick, keen mind and dynamic energy.

Then in 1905 a brilliant young Hungarian engineer, Joseph Galamb, joined the force. He had received a good technical education in Hungary, had worked in automobile plants in Germany, and after coming to the United States in 1903, had been employed by Westinghouse about a year, and by the Stearns Automobile Company for another. Short, dark-haired, with a small mustache, he looked like a figure from a

Molnar drama. In the spring of 1906 another expert technician, Oscar C. Bornholdt, was engaged to help design machine tools, and soon rose to the post of chief tool designer. Still another important addition to the group was the German-born Carl Emde, a fine engineer who was both fertile in ideas and precise in their execution. In 1907 Ford selected Fred Diehl, an expert in materials and specifications, for the key post of chief of purchasing—a post on which everything depended, for the flow of materials in a tight and highly competitive market did much to set the pace of production.

This growing force possessed an impressive fund of technical knowledge and experience, and a varied array of talents. Much of the achievement soon popularly credited to Ford was attributable to them and to the men who later joined them. It must be said, however, that they all recognized Ford as master. Bornholdt declared later that he was a man "of wonderful vision, and great skill in hammering out his plans."[44] Galamb, too, hearing Ford say many times over that they must make a car that "anybody could buy," was impressed by his chief's vision. And we have the revealing statement of Wandersee: "Mr. Ford kept in touch with everything in the experimental room, with every piece of paper on the board and everything in the shop, looking at the parts as they progressed. I believe that Mr. Ford always gave the designers a lineup of what he wanted designed. The ideas, I believe, were original with him."[45]

As for the office force, it was barely large enough by the time of the removal to Piquette to fill three automobile loads, as Ford's first secretary, Myrle Clarkson (later Mrs. M. F. Miller), subsequently recalled.[46] Among the new employees was a bookkeeper and clerk, Frank L. Klingensmith, a swarthy, nervous young man, who came at a salary of $65 a month. Another young fellow named Roberts assisted Klingensmith in handling secretarial work, which included correspondence related to the selling activities under Couzens.[47]

Ford and Couzens each dealt with his work according to his natural bent. Couzens was efficiently severe; a chill precisian, whose bursts of anger were feared by everybody, and a stickler for hard work and strict obedience to rules. Already he was one of the keenest, most experienced, and most ambitious businessmen in Detroit. Subordinates who suffered under his iron will found a compensation in the careful business training he gave them. His integrity was never questioned. Per-

haps his lapses of temper were excusable. His outer office was always crowded with importunate dealers, many of them protesting that they had sold their entire consignments before they even had a model to show customers, and with equally importunate manufacturers of materials and parts, voracious for orders, while his desk was covered daily with an avalanche of letters. Responsible for finance, bookkeeping, purchases, shipments, advertising, sales, and many lesser matters, he and his tiny staff carried a colossal burden.

As for Ford, he too worked persistently and indefatigably, though in a more relaxed fashion than Couzens, often laboring far into the night over mechanical problems. His passion for machinery, his thirst for better designs, his gift for unconventional approaches to old problems, kept his concentration at high pitch. But, unlike Couzens, he cared little about rules and regulations; while he drove his associates hard, he never lost his temper; and eager as he was to give greater system to automobile production, he was personally unsystematic—careless of everything but the immediate problem.

Visitors wishing to see Ford usually had a search on their hands, for he might be in the shop, the experimental department, the drafting room, or the power plant; he came and went as he liked. His avoidance of fixed office hours enabled him to escape interruptions. He paid only casual attention to his mail, and it was almost impossible to get him to read a two-page letter. Once Klingensmith, after prolonged search for an invoice, found Ford on the assembly floor and asked him about it. "It might be upstairs," Ford suggested; and going to the upstairs office, young "Kling" found enough unopened mail to fill two wastepaper baskets. The batch included checks, bills, and important letters. Couzens saw that he had to intervene. "From now on," he told Klingensmith, "it will be part of your job to open Mr. Ford's mail." "Kling" and Miss Clarkson thereafter took care of his correspondence. Before long Edsel, who was twelve the fall of 1905, sometimes came in after school to stamp letters.[48]

The boom in the automobile business made the labor problem in Detroit acute. During 1904–05 the difficulty of obtaining skilled hands steadily increased. Machinists, moulders, foundrymen, carpenters, lathe-operators, brass-workers, veneer-men—all were in keen demand. In the busiest months even ordinary laborers were hard to find. When in the fall of both years most automobile plants were closed for clean-up

and repairs, in preparation for the production of new models, the men thus made idle found work in other factories so easy to get that few turned up at the employment agencies.[49] Wages for unskilled workers rose to $2.00 and even $2.50 a day, and the Ford Company in 1905 paid them 28 cents an hour for a nine-hour day, while its rate for machinists was 42 cents. By the late summer of 1906 the *News-Tribune* estimated that Detroit could give jobs to fifteen thousand more men than were available.[50]

Other Detroit industries complained that labor was "automobile crazy"—that hands in older lines turned to the alluring novelty with its chance of better pay and rapid promotion. Furniture workers became car upholsterers; painters became automobile finishers; blacksmiths became machinists; woodworkers became body-men. "When will Detroit labor be stabilized?"[51] demanded employers. One manufacturer whose product demanded skilled wood-workers was later to declare that for a number of years he had practically turned over his entire working-force of two thousand several times annually.[52]

The Ford plant had to hire much unskilled labor and train it on the job, as most factories have always done. Henry Ford would have appreciated the experience of Samuel Colt when he set up his London arms-factory about a half century earlier. Colt began by searching for the highest priced mechanics available. "Then I tried the cheapest I could find," he told a parliamentary committee in 1854, "and the more ignorant a man was, the more brains he had for my purpose; and the result was this: I have men now in my employ that I started with two shillings a day, and in one short year I cannot spare them at eight shillings a day."[53] The total number of Ford employees, in business, mechanical, and sales departments, rose from about 125 at the close of 1903 to about three hundred during the busiest months of 1904 and 1905.[54] Shop workers had the benefit of assiduous training by Henry Ford, Wills, and Degener.*

All accounts agree that Ford himself was in these years still the life of the force. Though busy chiefly in the experimental room, he fre-

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* Like practically all other Detroit establishments then and for decades later, the Ford Motor Company was on an open shop basis. Men might or might not be union members, but Henry Ford discouraged membership on the part of executives. Fred W. Seeman relates that when he came to take charge of the pattern shop in 1904, he belonged to the Pattern Makers' *Union of North America*. Ford and Wills took him into a locked room. "Drop out of it," said Ford. "A foreman who handles men and handles his associates, has no business to belong to a union. Now, Fred, take it from a man who knows." Seeman reluctantly agreed to leave the union. (*Reminiscences*, Ford Archives.)

quently moved about the factory, jesting, telling stories in off moments, and playing practical pranks on the hands, but scrutinizing every operation.* "Everybody used to call him Hank or Henry," writes one early employee, "and he used to know everybody by name."[55] This would of course become impossible as employment climbed first high in the hundreds, and then into thousands.

His eye caught every hitch in operations, and he was quick to devise new expedients. In certain moods he was harshly arbitrary, and this "mean streak" was to grow. In general during this period, however, he seems to have been considerate of the workers.† He seldom gave a direct command. Instead, he would say, "I wonder if we could get this done right away," or, "It would be fine if you could do so-and-so." These hints were effective. "The men would just break their necks to see if they could do it. They knew what he wanted. They figured it was a coming thing, and they'd do their best."[56] Even in enforcing the basic rule of the plant against drinking he was tactful. Once he caught some road testers in a bar. He said nothing to them, but he did say much to Frank Kulick, who was responsible for their conduct —and Kulick passed it along.[57]

Of the three Ford models sold in 1904–05, the Model C runabout at $800 and the Model F touring car at $1000 (with physician's closed coupé $1250) did well; but demand for the Model B at $2000 was weaker. During the fall of 1904 the directors discussed changes in design for the 1905 season at considerable length. The price of the Model C was raised to $850 without tonneau and $950 with it; and it was equipped with a pair of oil side-lamps, and a post-horn.[58] After de-

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* Wandersee in his memoir emphasizes Ford's fondness for rough practical jokes. On the pattern-maker, Dick Kettlewell, Ford specially liked to play pranks. A week before Kettlewell's wedding, Ford gave Wandersee a trick cigar and said, "You see that Dick gets it." Wandersee let the pattern-maker take it, and the ensuing explosion singed Dick's eyebrows. But Ford did not let anyone play practical jokes on him in return.

† Frank Bennett (*Reminiscences*, Ford Archives) was in charge of the motor-test room. It was then a perilous job. "We would have to set the carburetor and we'd have to know whether they were hitting on four cylinders, which wasn't a very difficult job. In those days they had no

bating whether the tonneau should retain its rear entrance or be given a side entrance, the directors resolved to wait. But on the initiative of John Dodge, they decided to paint the running gears of Model C a light yellow, and fit it with three-inch tires, while equipping Model F with three-and-a-half-inch tires.[59] A contract was let to Dodge Brothers for furnishing two thousand "rigs" (engines and gears), beginning with 150 in January and rising to 400 a month in March, April, May, and June, at the same price and conditions as those fixed the previous year.[60]

A great white-lettered sign ran along the side of the Piquette Avenue plant: "The Home of the Celebrated Ford Automobile." By May, 1905, large placards reading "Loaded With Ford Automobiles" were being affixed to freight cars daily leaving the works—and sometimes these placards covered the greater part of a freight train.[61] Gross sales for the year October 1, 1904, to September 30, 1905, rose to $1,914,903, a gain of about $710,000 over the previous year, and net profits for the same period, after deducting all costs of plant expansion, were $290,194.[62] It was possible on June 16 and July 24, 1905, to declare two dividends of $100,000 each, which were announced in the press and proved good advertising. The company had plans for a new building on the empty yard just west of the Piquette Avenue factory, which it had used for testing cars. Ford, who was experimenting on his Dearborn farm with the application of gasoline motors to farm implements, radiated confidence. So did Couzens, who expected an indefinitely rising curve of orders.

"We are now turning out twenty-five machines a day on an average," Couzens told a newspaperman in April, 1905, "and giving employment to three hundred men." He prophesied that the manufacture of motor vehicles would become the greatest industry in the world. The plant superintendent, Andrich, declared that in no long time he hoped to reach an output of sixty machines a day, each as good as any of its class.[63]

Henry Ford's dreams for the future were more ambitious still. On May 9 and 10, 1905, the Detroit evening and morning papers carried headlines: "Plan Ten Thousand Autos at $400 Apiece." Ford, calling in the reporters, had declared that he meant to reach the masses. "It will take some time to figure out what we can do," he remarked, "and we do not care to say much until we know what the result will be."

A journalist asked when he would drop the price from $400 to $300. "Hard to say," he replied. "Tires alone cost $60 to $70 a set. That machine will come when there is a general decline in prices all along the line."[64]

5.

The Fords continued to live at their little house on Hendrie Avenue, paying $16 a month, until 1905. On March 8 Henry's father William Ford died there in his seventy-ninth year. Soon afterward Henry and Clara moved to 145 Harper Avenue. They followed a social routine that was much simpler than their growing wealth might have suggested. Their relatives, a few old friends, a few Ford dealers and agents liked Plantiff and Perry—these were their guests. They ordered bottled grape juice—"malto grape"—from a firm in Paw Paw, Michigan, and apparently this was what they served to visitors. Lady Perry remembered Ford as a cordial host. "Won't you have some fruit-juice?" he'd ask, and serve it himself.[65]

Edsel had started to school, riding his bicycle; he was a lively youngster, with his share of good spirits, and from the first showed an interest in the business. This was apparently quite spontaneous. At the same time, Edsel was sensitive from an early age to the wishes of his parents. He had been their companion from babyhood and seemed to realize how much he meant to them. They were never to have cause to reproach him with thoughtlessness or lack of consideration. Even as a youngster, he behaved with a quiet common sense that, were it not for his high spirits and ready love of fun, might have been mistaken for docility.

At the same time, at first on West Grand Boulevard off Fourteenth Avenue, a workingman's neighborhood, then on the more genteel Frederich Street, and finally, in 1905, in their own bungalow at 80 Chandler Avenue, James Couzens and his family were paralleling the experience of the Fords. They had begun married life in 1898, ten years later than Henry and Clara, had two small boys and a girl (Homer, Frank, and Madeleine), were devoted to each other, and seemed an ideally happy couple. At home, Couzens was a different man from the driving, short-tempered executive in the office. He relaxed, strove to please his wife, and enjoyed being called "Daddy Jim" by the children. In later years he looked back on this period with a

sentimental fondness.[66] Probably the Fords did, too, although neither was ever to say so. These years were the last in which they could enjoy the happiness of living as ordinary people lived. Fame was soon to end their privacy, except as they fought for and painfully guarded it.

Before long the two wives became acquainted. Their relationship was cordial, reflecting that of the two men at the plant.[*] Apparently there was no association on the part of the children: Edsel was seven years older than Homer Couzens. With time, Clara seems to have taken a dislike to Couzens himself—it was not difficult to do so—and to have felt that he was assuming too big a role in the Company. Ford for reasons of his own gradually formed a similar opinion, and the families somewhat drifted apart as the respective heads became less intimate, though they continued to keep in touch with each other.

6.

While outwardly all was prosperity and harmony in the affairs of the company, under the surface strong currents of dissension were running. As sales and profits grew, Malcomson ruefully perceived that he should have given his main energies to the automobile and handed management of the coal company over to Couzens! He made vain efforts to retrieve the ground he had lost. The result was a running battle with the allied managerial heads, Ford and Couzens. Malcomson's first move was to demand that Couzens return to the coal business while he himself took the place originally planned for *him* as business head of the Ford Company. Of course Couzens refused, and of course Ford stood by him. "I told Malcomson that I did *not* want him but that I wanted his man Couzens,"[67] he remarked later. Thereupon Malcomson is said (though no reference to this appears in the minutes) to have moved at a directors' meeting that Couzens be displaced.[68] He protested violently when the directors on September 9, 1905, raised Couzens's salary from $4000 to $8000, but was voted down.[69]

Simultaneously, the differences between Malcomson and Ford on the relative emphasis to be given cheap and expensive types of cars raised questions of far-reaching import to the company and the whole automobile industry.

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[*] When Couzens went to Europe in 1907 he sent Edsel numerous postcards, written in terms indicating a real affection for the boy. The cards almost invariably expressed a keen desire to get the trip over with and return to the good old U. S. A.! Henry Ford in 1909 sent young Homer Couzens a twenty dollar gold piece.

As soon as they moved into the Piquette plant, Ford, Wills, and their aides began designing two new models. One was for a moderately priced car, the four-cylinder Model N, planned as an improvement upon the Models C and F. Much complaint was still heard of the defects of these old models, as in fact of all cars of the day. The biographer of Couzens quotes items from his notebook in 1906: "Radiator leaking." "Nuts on lamps hurt in cranking." "Cushion on rear seat not fastened." "Wood screws on fenders don't hold."[70] The complaints which he thus recorded to be sent to the production department were seconded by letters from numerous irritated car owners. Ford was confident that he could eliminate the worst faults, introduce various improvements, and manufacture the Model N at low prices in huge quantities.

Malcomson, however, had fallen in love with the design of the much costlier six-cylinder Model K, of which he had high expectations; and he received some support from the Dodge brothers, who knew that the current trend was toward big cars. Directors' meetings grew stormy. Much pounding of the table took place, and the little group, in which the five men had one vote each irrespective of the size of their stock holdings, sometimes broke up angrily. In the industry as a whole, expensive cars were unquestionably gaining in favor. In 1903, automobiles selling at $1375 or less had constituted about two-thirds of total production. The proportion of such cars sold steadily decreased, until in 1907 the situation would be reversed; two-thirds of the cars sold would cost more than $1375, and only one-third would cost less. The reasons for the trend were complex: they included the general prosperity of the period, an era of luxury setting in; the steady advance of urbanization, many city dwellers preferring large cars; the belief of many buyers that they could get rid of the nuisance of constant breakdowns and repairs by turning to heavy models; and the desire for more speed and power, which meant relatively ponderous engines—for the high speed engine of small cylinder bore but great power had not yet been developed.[71] Malcomson could argue that the country wanted cars costing from $2275 to $4775. In 1906 nearly half of the automobiles distributed fell within this upper price range; and nobody could foresee that ten years later they would enjoy less than two per cent of the market.

Ford, however, had from the beginning wished to make just one type of car by quantity production of a simple standardized design, at

prices enabling the great body of Americans to substitute a family automobile for the family horse. He had told John W. Anderson in 1903: "The way to make automobiles is to make one automobile like another automobile, to make them all alike, to make them come through the factory just alike; just as one pin is like another pin when it comes from a pin factory, or one match is like another match when it comes from a match factory." He planned ultimately to outsell the Oldsmobile, then priced at $650 at the factory. Charles E. Sorensen records that Ford told him again and again of his ambitions, and of his disgust with Malcomson's wish to cater to the wealthy. "At times in my talks with Mr. Ford I could see that he was rather discouraged about the way matters were going."

This divergence of aim intensified the conflict for company control between Malcomson on one side, Ford and Couzens on the other. From the outset the active managers held the advantage. John Dodge, despite his preference for the costlier car, stood with Ford; he "did not like Malcomson,"[72] he said later—partly because when the Dodge contract had come up for renewal, Malcomson had argued for reduced payments on the ground that the risk was now less. Gray too, for reasons of policy, sided with Ford and Couzens.

Malcomson's position was given seeming strength by the fact that the movement of the market toward heavy, expensive touring cars (a term just gaining general currency) was unmistakably accentuated [illegible] the spring of 1905 wore on. Automobile journals expended considerable pains upon an analysis of the demand for high-priced automobiles, coming to the conclusion that too many manufacturers had rushed into the small-car business, with a resulting shortage of expensive models, that the country was "full of money," and that many buyers who had started with cheap runabouts had been educated to the larger, more costly types.[73] But many experts never ceased to believe with Ford that the future lay primarily with the small car. The sales manager of the Packard Company said in an interview in the *Motor World* of May 11, 1905, that while the trend would probably force his company to build some seventy-horsepower cars the next year, a reaction was certain when users got tired of colossal tire, gasoline, and repair bills; and he accurately predicted that the "disease" had only about eighteen months to run. Makers of small cars remained confident.

"All the auto manufacturers are planning more or less violent changes for the next year's trade," said C. E. Mann of the Michigan Automobile

and Carriage Manufacturing Company in the spring of 1905. "Bodies will be more graceful and better adapted to the purposes for which they are intended. The small machine of moderate cost is nearly here. One company is now making a serviceable auto for $325. It is large enough for two. Others must follow in its wake. We would today see more of these cheaper autos on the streets had there not been a delay in supplying engines."[74] Ford, talking with men in the plant, often said that he wished to turn out a car that workingmen could buy.[75] He also often said that a lighter car would mean better engineering. The typical early roadster with tonneau weighed 1500 pounds, and if it carried four adults, the total weight reached a ton. But if the four-seated car could be reduced to 1100 pounds, a level soon to be reached by the Ford Company, the saving in weight would be one-fourth; the engine could then be reduced in size, or if kept large, would be proportionately stronger. As a matter of fact, before many years passed the Ford Company would advertise that the fifteen-horsepower engine in its 1100-pound car was equivalent to an eighteen-horsepower engine in a 1500-pound car.[76]

The situation in the Ford Company this summer of 1905 was paralleled by that in the Olds concern at about the same time. The gifts of R. E. Olds as designer, the skill and energy of Roy D. Chapin (later Secretary of Commerce under Hoover) as sales manager, and the appeal of low prices for a car of fair reliability, had laid the foundations for a highly successful business. In the first year of Chapin's management, 1904, the sales of the light Olds runabout rose from 4000 to 5000, and the next year to 6500. Unhappily for the company, its financial backer, F. L. Smith, desired to create a business for his two sons; and these young men insisted that more expensive models be given primary attention—for like Malcomson, they believed in the rich man's market. Olds was forced out, and against Chapin's stubborn opposition, the high-priced models were pushed to the front. The consequences were catastrophic. Although the low-priced roadster continued to furnish revenues, the heavy cars piled up mounting losses until the cash reserves were exhausted and the company sank into debt. Disruption followed. Chapin and three other enterprising young executives departed in disgust early in 1906, to found what three years later became the Hudson Motor Company.[77] The Olds Company was left almost prostrate.

Malcomson was supported among the stockholders by his cousin,

Vernon Fry, and his friend, Charles H. Bennett, but not by his astute uncle John S. Gray. As the quarrel grew more acrid, the two active heads resolved to thrust Malcomson to one side. They felt that it was *their* pooling of mechanical and business talents which had set the factory on the highroad to success; they resented Malcomson's absorption in other affairs; and they believed that future profits would be in quantity distribution of an improved low-priced car which Ford was already planning, later to be called Model N. The differences in temperament and outlook were becoming unendurable. Malcomson, a born adventurer, believed that he could oversee several businesses at once, and substitute instinct and impulse for careful, methodical planning. The cautious, systematic, disciplined Couzens, and the hard-working Ford with his passion for simplification, standardization, and efficiency, regarded him as an impractical, meddling, and parasitic—Ford used that harsh term—outsider.

A bold idea, which may have originated with Ford, with Couzens, or with both, made it possible to cut the two intertwined knots at once. If the company was to prosper by mass production of a cheap car, the shelving of Malcomson was no more important than the expansion of operations to include engine manufacture; for as competition tightened, the profits that the Dodge Brothers had made from supplying engines, gears, and frames ought to be kept within the Ford concern. "Mr. Ford was always in favor of having the Ford Motor Company make its own things," recalls Wandersee. Obviously, too, a more efficient production manager than Andrich would be needed, and he could be found. It was impossible for the Ford Company to have much future as a mere assembler of parts. One by one, other automobile companies were becoming their own engine-makers. If Ford and Couzens formed a new company to undertake engine and parts manufacturing, they could bring the old dependence on the Dodge Brothers to an end; while at the same time they could themselves absorb the profits on the *manufacture* of the new car, leaving Malcomson only his share in the profits from its *sale*, and from that of the more expensive car which he favored. Perhaps from the start they intended to use the Ford Manufacturing Company as a device to increase the cost of production (on which they profited), and thus reduce for a time the dividends of the Ford Motor Company which were Malcomson's only return on his investment.

7.

For two very different reasons, therefore, on November 22, 1905, the Ford Manufacturing Company was incorporated with a capital of $100,000. The announced purpose was to make engines, running gears, automobile parts, and all kinds of machinery and appliances. As a matter of fact, the company intended to make engines and gears for the cheap car only, the new Model N; Dodge Brothers would continue to make this machinery for the costly car. A mere $50,000 of stock was subscribed, and only $10,000 paid in cash. Malcomson received no stock. Seven other men—the two Dodges, Rackham, Anderson, Wills, Couzens, and Bennett—were allotted 350 shares each.* Bennett, however, shortly transferred his shares to Ford, who then held 2900 out of the 5000 issued.[78] The reason for this transfer is revealing: Malcomson, enraged at being thus shouldered aside, threatened to bring suit, and Bennett did not wish to become his opponent in unpleasant litigation. Ford was elected president, John F. Dodge vice-president, Wills secretary, and Couzens treasurer.

Ford's control of the new company suggests that his determination to manufacture the most important parts of the cars bearing his name was a primary motive in the new undertaking. But we have a statement by Gray which clearly demonstrates that a secondary objective was the jettisoning of Malcomson. When Vernon Fry expressed apprehension that the Manufacturing Company might injure the Motor Company, Gray replied: "I have Mr. Ford's promise that when they get things straightened out with Mr. Malcomson, the Ford Manufacturing Company is to be taken into the Ford Motor Company, just as if it had never existed."[79]

Malcomson unquestionably intended to fight, but in characteristically impulsive fashion he put himself on indefensible ground just as the battle began. On December 5, 1905, the Detroit *Free Press* carried a news story headed "New Auto Plant," announcing the formation of the Aerocar Company, capitalized at $400,000, with Malcomson as its head. He owned a majority of the stock—$204,000 par value. The company, which had been formed in recent weeks, had already begun

* The first meeting of stockholders of the Ford Manufacturing Company was held November 28, 1905, with Rackham acting as chairman Five directors were elected, Ford, Anderson, Couzens, John F. Dodge, and Wills, and the action previously taken by Wills in leasing premises for a machine shop and factory was ratified. Minute Book, Accession 85, Ford Archives.

to build a large three-story factory on Mack Avenue, and announced that it would make at least five hundred touring cars, with air-cooled engines, for sale in 1906. They hoped to double the capacity of the plant within six months.[80] Obviously, Malcomson meant to use his share of the Ford dividends to build up a rival to that corporation.

The other directors of the Ford Company at once showed their resentment. Meeting on December 6, they adopted a resolution stating that they had received information that Malcomson was not only a large stockholder in a rival automobile company, but an officer and director; that his participation was against the best interests of the Ford Company; and that he was therefore asked to resign as treasurer and director of Ford within five days. This resolution was offered by Rackham, and seconded by Henry Ford.[81] Malcomson, as was expected, refused to resign. Instead, he penned on December 15 a heated letter, read at the Directors' meeting a week later, in which he declared that his connection with the new company would not diminish in the least his activities on behalf the older corporation; that the directors seemed to overlook the fact that he was owner of more than one-fourth of the Ford Motor Company stock, whose values he would naturally wish to protect; and that he had been sadly grieved and injured by recent acts of the Ford Motor Company:

> Such occurrences as the recent precipitate action of the Board in doubling the Manager's salary, despite protest and without waiting for a full Board meeting, are not calculated to induce the belief that my withdrawal would result in management more careful of the stockholders' interests. It is true that there may be reasonable differences of opinion over matters of expense, and instances of increased expense are important only as showing a general tendency to sacrifice the interests of the general body of stockholders to those of some individuals. The most striking instance of this tendency . . . is the organization of the Ford Manufacturing Company, comprised and controlled by the holders of the majority both of stock and directorships of the Motor Company, and designed, as I am reliably informed, to sell its products to the Motor Company—presumably not without profit. In this new company the minority stockholders were not invited to join. It seems the revival of a plan rejected not long ago with general satisfaction but now apparently made acceptable to those who formerly were energetic in opposing it, by the prospect of participating in the profits and of confining the injury to those stockholders of the Motor Company that are left on the outside.
>
> I consider this scheme to be as unwise as it is unfair, and I propose to exer-

cise whatever power my official position in the Motor Company may give me as well as—if it becomes necessary—my rights as a stockholder, to prevent the accomplishment of the result for which the plan was designed. . . .[82]

It is of course obvious that Malcomson was largely in the wrong. He could not properly be president of the Aerocar Company and treasurer of the Ford Company; to the extent that the new venture succeeded it might injure the older one. But for the time being he held both places, perhaps hoping to force Couzens and Ford to a compromise.

The Piquette plant was not large enough for the quantity manufacture of Model N engines and gears; and the Ford Manufacturing Company therefore leased a building at 773-775 Bellevue Avenue from the Wilson & Hayes Manufacturing Company. Here it at once began installing tools, jigs, dies, fixtures, and machinery for making engines and transmissions. Part of this equipment was purchased from a magnetic, ambitious machinery salesman and machine tool expert named Walter E. Flanders, a Vermonter by birth, who had become apprentice in a machine shop at fifteen, worked for a time in one of the Singer Sewing Machine plants, and perfected his experience by service with the Landis Tool Company. As a seller of machinery and a practical consultant on its uses, he had gained a clientele embracing many of the principal industrial concerns of America and Europe. Ford liked his friendly, affable manner, broad views, and pithy speech.[83] With the new equipment, the Manufacturing Company would furnish motive-plants in quantity for the cheap Model N's with which Ford hoped to turn a new page in automobile history. Meanwhile, the Dodge Brothers would supply engines and transmissions for the expensive cars (Model B and later Model K) which Malcomson favored; all types being assembled in the Piquette factory.[84]

For superintendent of the Bellevue Avenue plant Ford hired Max F. Wollering, whom Flanders recommended as a young man familiar with the newly-installed machinery and able to boss the hands. He was by far the ablest director of assembly the company had yet employed. In recent years he had worked for the International Harvester Company, for which he had built machine tools and directed the manufacture of stationary gas engines, and for the Hoffman Hinge and Foundry Company in Cleveland. Arriving in early spring of 1906, Wollering found the last equipment being set in place, with heavy machines on the first floor and lighter pieces on the second. He thought the

factory "a nice little plant." A desk and telephone were assigned him in the tool-crib, with two office assistants. Under his oversight were seven departmental heads, though Ford disliked formal gradations of rank: one man in charge of cylinder blocks, crankcases, and axles; one responsible for bushings and other small parts; one in control of motor assembly; one supervising the second floor machinery; one who looked after toolmaking and tool-supplies; one who directed the motor testing; and a chief inspector. The working force at the outset comprised about 125 men. But the Manufacturing Company was just making ready for the rapid production of engines, axles, differentials, and other parts, and the number of workers would leap forward as summer brought the plant into full operation.

A crisis had been reached in the history of the Ford enterprise. Two companies had taken the place of one; Ford's chief associate in founding the business was now his enemy; a legal battle seemed imminent. Actually, the result of the contest was never in doubt, and the founding of the Ford Manufacturing Company represented a vigorous forward surge in policy. This fact was made plain by the exuberant advertising with which Ford and Couzens ushered in the year 1906, proclaiming that they were on the point of turning out inexpensive cars in unprecedented numbers.[35] "We are making 40,000 cylinders," they announced, "10,000 engines, 40,000 wheels, 20,000 axles, 10,000 bodies, 10,000 of every part that goes into the car—think of it! Such quantities were never heard of before." The new Model N was to be revolutionary. "For this car we buy 40,000 spark plugs, 10,000 spark coils, 40,000 tires, all *exactly alike*." And the advertisement played up Henry Ford's principle of ever-larger numbers of identical cars made at ever-lower prices:

> Henry Ford's idea is to build a high-grade, practical automobile, one that will do any reasonable service, that can be maintained at a reasonable expense, and at as near $450 as it is possible to make it, thus raising the automobile out of the list of luxuries, and bringing it to the point where the average American citizen may own and enjoy his automobile.
>
> So in making the price on the 4-cylinder runabout, the question was *not*, "How much can we get for this car?" but "How low can we sell it and make a small margin on each one?"—"How many cars must be turned out to get the lowest cost per car, and will the demand absorb this tremendous output?"

> These have been mighty questions.
>
> To build the number necessary to sell a car of this class for less than $500 was a proposition that staggered every man in the automobile industry.
>
> But the Ford Company are doing it, and as a result thousands of people will own a good car this year where otherwise it would have been impossible.

This was arrant bragging, of course; it was far from accurate in detail—the Ford Manufacturing Company did not make 40,000 wheels, or 10,000 bodies, but bought them; its promise that the Model N runabout would sell for $450 was not to be redeemed. But it was a correct statement of the principle on which Henry Ford was working, and for the sake of which he had come to his breach with Malcomson.

XIII

THE SHADOW OF MONOPOLY

On October 22, 1903, the Electric Vehicle Company and George B. Selden filed suit in the United States Circuit Court for the Southern District of New York against C. A. Duerr & Company and the Ford Motor Company for infringement of the Selden patent. The Ford Company was really the sole defendant, Duerr being its agent in New York. The opening gun of a war that was to last for almost eight years, the suit arrested the attention of automotive men everywhere. Even prospective purchasers watched anxiously, for by this time the sweeping character of the Selden claims was widely known.

The battle had an interest transcending the industry. Trusts and other monopolies had bulked large in men's thoughts for a generation. They had been a leading issue in the last Presidential campaign. Ida M. Tarbell was electrifying American readers with her *History of the Standard Oil Company,* which had appeared serially in *McClure's Magazine* for almost a year. Now, as the manufacture of motor cars began to promise large profits, a wealthy group of financiers and industrialists was attacking a little automobile company which had just commenced operations with a working capital of only $28,000.

The attack would not have justified the cry of attempted monopoly if Selden and the Electric Vehicle Company (acting for the Association of Licensed Automobile Manufacturers) had held a patent of unquestioned validity and been willing (like the United Shoe Machinery Company, for example) to let all responsible concerns use it. A fairly-gained patent on an invention was respected and even honored. But the complainants for two reasons held a dubious position: first, many competent observers believed that their patent was defensible neither ethically nor legally, and second, the A. L. A. M., which controlled its own membership, reserved the right to *deny* licenses. If it won the

suit it might withhold them from the Ford Motor Company and a hundred other "independent manufacturers."[1] This fact gave the A. L. A. M., with its small membership of only twenty-six firms, a menacing aspect. In vain it denied monopolistic intent; its opponents feared that their very existence was at stake. Public interest in the contest was heightened by the fact that although Ford battled alone, he might summon powerful allies. While the Electric Vehicle Company and the Association of Licensed Automobile Manufacturers were said to represent resources of $70,000,000, the independents were credited with a combined capitalization of $27,000,000.[2] Thus the struggle might involve titanic interests.

However, in October, 1903, the Ford Motor Company stood isolated and was prepared to fight even without allies. Many observers correctly guessed that only as it sold cars could the little corporation finance the contest. Its jeopardy seemed the greater because in previous suits the E. V. C. had emerged victorious. Repeatedly it had won important settlements, though never a decisive legal validation of its patent. Now it was ready if necessary to defend its patent in the highest courts; and this would be necessary, for Couzens and Ford had announced emphatically that they would never compromise.

Fully to understand the suit, we must go back a few years to the patent and its exact nature; to the process, spiced with the preposterous, by which it became an instrument in the hands of a powerful group; and to the preliminary clashes between the Ford Motor Company and the A. L. A. M. which had brought the parties into court.

2.

We have seen that soon after filing his application for a patent on a motor carriage in 1879, Selden had deliberately delayed its issuance, making minor "improvements" and amending his plea year after year in a fashion which prevented final action. He did not wish time to begin running on the patent until the automobile industry was born. Finally, he permitted his application to be acted upon, and on November 5, 1895, received patent No. 549,160. It came to him sixteen and a half years after he had first filed. The United States Commissioner of Patents in his annual report referred to Selden's conception as one "which may be considered the pioneer invention in the application of the compression gas engine to road or horseless carriage use."[3] Hav-

had been Secretary of the Navy under Grover Cleveland, had become interested in developing electric cab services in a number of cities, his Electric Vehicle Company already having a promising start in New York. The Pope organization seemed to be the only American firm capable of building the 200 cabs he wanted immediately;[8] and he found it pleasant to deal with the company because H. Hayden Eames, Maxim's immediate superior, was a former naval officer of high ability.

Whitney's ideas were of imperial scale, and he had money to implement them. With Day and Eames he quickly made plans to merge the Pope automotive plant and its patents with the Electric Vehicle Company. The new corporation was to be capitalized at $3,000,000, each of the two prior interests being valued at $1,000,000. The 200 electrics originally contemplated now mushroomed to a dazzling 1600, Eames guaranteeing an extension of the plant for their manufacture. Since the bicycle trade was declining, the Pope officials were elated at the prospect of getting $1,000,000 for their struggling automotive department.

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ing a life of seventeen years from the date of issue, the patent would be good until November 5, 1912.

What exactly had Selden tried to cover? He stated in his application: "The object of my invention is the production of a safe, simple, and cheap road-locomotive light in weight, easy to control, and possessed of sufficient power to overcome any ordinary inclination." Pointing to the waste involved in driving heavy carriages by steam, with "the skilled attendant and the steamboilers, water, water-tanks, coal, and coal-bunkers" necessary for their operation, he asserted that he had done away with such drawbacks by using as his power plant "a liquid hydro-carbon engine of the compression type." While "hydro-carbon" might include a number of elements, Selden had in mind petroleum products, especially gasoline and kerosene. This engine, he stated, might be of one cylinder or several, and might take any of various forms. He described in some detail the vehicle to be used, but in functional rather than mechanical terms. It was to have a propelling wheel, a steering mechanism, a receptacle for liquid fuel, a power shaft (crank shaft) connected with and running faster than the propelling wheel, a clutch or disconnecting device to vary the speed, and an unencumbered body for passengers. The engine was to be placed on the front axle beneath the seat, although Selden indicated that other positions were possible. It was to have a cooling device,[4] and a flexible or jointed connection with the body. A brake and an awkward method of reversing the direction of the vehicle were indicated.

These specifications covered the chief features of the modern gasoline automobile, although only as to broad function. Selden did not pretend that a single one of the features was new, but asserted that the *combination with the hydrocarbon engine* represented an invention. As noted previously, he had experimented with an engine, but, failing to find backers, had never built a vehicle.[5] He contended, however, that his engine and vehicle were *operable*, and that as no previous inventor had received a patent for such an *operable vehicle*, his patent was basic. All machines developed after 1879 were covered by it, and after 1895 could not be built, sold, or used without his permission.

To those not minutely acquainted with automotive history, Selden's claim seemed strong, and the patent stamped it with official recognition. However, the law permitted a test of any patent in the courts, and engineers and manufacturers who had seen the automobile grow

were quick to jeer at his pretensions. Hiram Percy Maxim later recalled how, when first shown the patent by his associate Herman F. Cuntz, "I snorted my derision. I pointed out that the engine shown in the patent was utterly impractical and a joke. . . . The claims were so broad that they are ridiculous."[6] He was typical of men who had developed cars. They quickly perceived that Selden's engine was a two-cycle motor of the Brayton type, compressing the charge outside the cylinder, and burning instead of exploding it.[7] How then could he cover the four-cycle, internally compressing, exploding Otto type of motor? Again, all the elements in his combination had been used in connection with steam, gas, and even naphtha engines before he filed his application. Did merely putting these elements together constitute an invention? And if he had one, why had he not built a car?

Selden, unperturbed by such comments, declared that his patent covered *any* type of compression gasoline engine. Certainly he had thought the problem of the modern gasoline road carriage through with considerable thoroughness, and had framed a clearer description of it than any of his predecessors. Probably Benz or Daimler in 1879 could have drawn up a patent application which would have been as comprehensive in general terms and far better in some details; but neither had done so.

However, regardless of the merits of his patent, Selden in 1895 could not move to enforce it. Court action would be necessary, and this would require strong financial support; Selden had little money and was busy with his regular legal work. Four years passed during which he made no move to challenge any manufacturer of automobiles—indeed, until 1898 there were few worth challenging. In 1899 he seems to have found a potential supporter, but before negotiations had gone far, one much more promising appeared.

It will be remembered that the Pope Manufacturing Company, beginning in 1895, had experimented with both gasoline and electrically propelled vehicles, Maxim conducting the work upon both types. By 1899 successful models of the two were on the market. Because George H. Day, the vice-president of the Company in charge of automotive work, favored the trim, quieter electric, models of this machine were specially featured. The success of the Pope Company brought to Hartford in April, 1899, William C. Whitney, representative of a group of New York investors which included Thomas F. Ryan. Whitney, who

had been Secretary of the Navy under Grover Cleveland, had become interested in developing electric cab services in a number of cities, his Electric Vehicle Company already having a promising start in New York. The Pope organization seemed to be the only American firm capable of building the 200 cabs he wanted immediately;[8] and he found it pleasant to deal with the company because H. Hayden Eames, Maxim's immediate superior, was a former naval officer of high ability.

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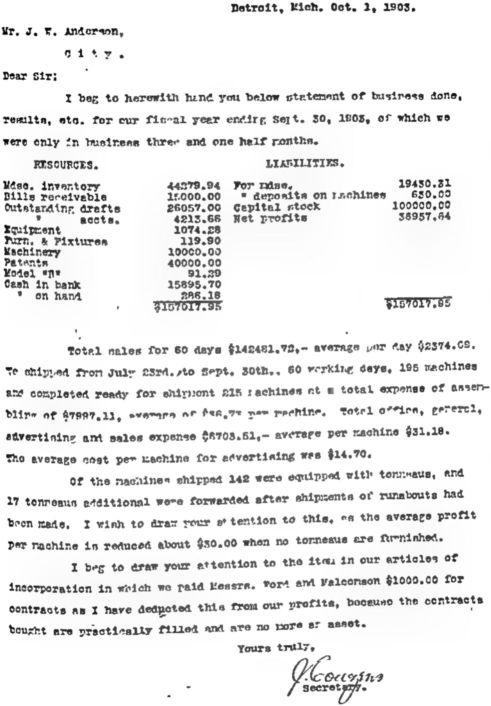

Detroit, Mich. Oct. 1, 1903.

Mr. J. W. Anderson,

City.

Dear Sir:

I beg to herewith hand you below statement of business done, results, etc. for our fiscal year ending Sept. 30, 1903, of which we were only in business three and one half months.

RESOURCES.		LIABILITIES.	
Mdse. inventory	44279.94	For mdse.	19430.31
Bills receivable	15000.00	" deposits on machines	630.00
Outstanding drafts	26057.00	Capital stock	100000.00
" accts.	4213.66	Net profits	36957.64
Equipment	1074.28		
Furn. & Fixtures	119.90		
Machinery	10000.00		
Patents	40000.00		
Model "B"	91.29		
Cash in bank	15895.70		
" on hand	286.18		
	$157017.95		$157017.95

Total sales for 60 days $142481.72,- average per day $2374.69. We shipped from July 23rd./to Sept. 30th., 60 working days, 195 machines and completed ready for shipment 215 machines at a total expense of assembling of $7897.11, average of $36.73 per machine. Total office, general, advertising and sales expense $6703.51,- average per machine $31.18. The average cost per machine for advertising was $14.70.

Of the machines shipped 142 were equipped with tonneaus, and 17 tonneaus additional were forwarded after shipments of runabouts had been made. I wish to draw your attention to this, as the average profit per machine is reduced about $30.00 when no tonneaus are furnished.

I beg to draw your attention to the item in our articles of incorporation in which we paid Messrs. Ford and Malcomson $1000.00 for contracts as I have deducted this from our profits, because the contracts bought are practically filled and are no more an asset.

Yours truly,

J. Couzens
Secretary.

Couzens reports nearly $37,000 profits in the first three and one-half months.

had been Secretary of the Navy under Grover Cleveland, had become interested in developing electric cab services in a number of cities, his Electric Vehicle Company already having a promising start in New York. The Pope organization seemed to be the only American firm capable of building the 200 cabs he wanted immediately;[8] and he found it pleasant to deal with the company because H. Hayden Eames, Maxim's immediate superior, was a former naval officer of high ability.

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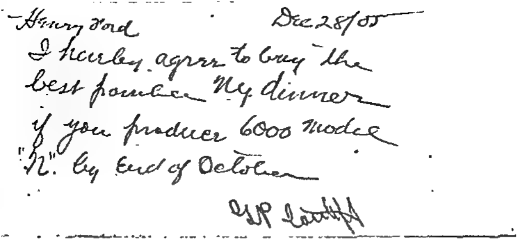

Henry Ford Dec 28/05

I hereby agree to buy the best possible NY dinner if you produce 6000 model "N" by End of October

GP Plantiff

Gaston Plantiff promises Henry Ford a dinner if a production mark is met.

Twelve Ford employees at the Mack Avenue Plant as the 1904 racer is made ready for Frank Kulick. (On extreme left, P. E. Martin; in shirtsleeves and cap, August Degener)

report about Wall Street's interest in Selden took on such importance that Whitney decided to approach the inventor directly. Meanwhile, the Columbia & Electric Vehicle Company was organized as a manufacturing unit for the electrics Whitney wanted. Selden shortly proposed to give this new company a "definitive license," practically an assignment of the patent, for $10,000 and a percentage of whatever royalties could be collected.

The Pope-Whitney forces, obtaining an option on this arrangement until January, 1900, investigated the possibilities of the situation. While Maxim was sent to Rochester to examine the engineering aspects of the patent, Cuntz visited a number of automobile plants. Finally William B. Greeley, a patent attorney, took ship for England and there discussed the patent with Dugald Clerk, regarded as the world's outstanding authority on gas and gasoline engines. He pronounced Selden's claim valid! In November, 1899, the agreement was signed and Selden was paid his $10,000.[11]

Another fantastic aspect of the history of the patent lay in the hostile attitudes of Whitney and Day toward gasoline automobiles. Whitney, of course, had been interested solely in electrically propelled vehicles, and the Columbia & E. V. C. had been organized chiefly to build them, although it also had facilities for the production of gasoline models. Thus a company devoted to and named from electrics acquired a patent on a rival type of car and proposed to shake it as a club over the heads of manufacturers. As for Day, he had never believed in gasoline models. Maxim relates how in 1896 Day had shuddered when he took his first brief ride in an experimental carriage of this type, with its noisy motor and ugly, clanking body. Later, after a better gasoline car had been devised, he came into the experimental room at the Pope works one day, when the mechanics had opened up the box in which the change of gears for the machine was housed.

> "He spied the gears in the box [related Maxim] all of them swimming in black oil. . . . In a shocked sort of a way he asked me what all the cog-wheels were for. I told him they were the change gears. . . . He looked at me a moment, shook his head and walked away. . . . After a few minutes he beckoned to me. I went over to him and he said, 'Maxim, is it necessary to have all those gears in a carriage?' I repeated that there was no possible escape as long as a gasoline-engine was used. He went on to ask, 'And you have to have all that oil?' I explained that the gears ran more quietly in oil

and that the bearings also needed oil. . . . Again shaking his head sadly, he announced emphatically: 'Well, then, Maxim, let me tell you something. We are on the wrong track. No one will buy a carriage that has to have all that greasy machinery in it.'"

Fortunately Day was not permitted to halt the work on gasoline carriages, which throve at the Pope plant and elsewhere. Some years later he and Maxim were walking up Fifth Avenue. Already more than half the vehicles on the street were gasoline automobiles. The engineer asked if Day recalled the episode in the experimental room at Hartford. Seizing his companion's arm, Day laughed ruefully: "Great Scott, Maxim! Do you remember that? I was awfully wrong, wasn't I?"[12]

If Day had not adopted this view personally by 1900, he had gone far toward doing so officially. He and his associates in the Columbia & Electric Vehicle Company, of which he was president, were all pleased by the apparent strength of Selden's claims. If electrics were still *their chief* concern, the gasoline models were multiplying, and the opportunity to levy tribute upon them promised golden rewards. The firm of Betts, Betts, Sheffield & Betts, serving the E. V. C., shared their confidence in the patent. They spent the early months of 1900 in preparing a crushing case against any recalcitrant manufacturer. By June they were ready to act, and began serving warnings of infringement in the name of the Columbia & Electric Vehicle Company.[13] "Our clients inform us," ran the text, "that you are manufacturing and advertising for sale vehicles which embody the invention of the Selden patent. . . . We notify you of this infringement, and request that you desist from the same and make suitable compensation to the owner of the patent therefore."

The first responses were hostile. *Motor Age,* then in its second year of life, at once announced its opposition, and urged that the industry present a united front against what it regarded as an audacious but dangerous attack. It printed a letter from a patent authority, R. M. Hunter of Philadelphia, which characterized Selden's claims as "too preposterous to merit serious consideration."[14] The patent-holders were ignored or sharply rebuffed by those they had notified of infringement. Two legal suits were thereupon begun in the Federal Circuit Courts: the first on July 12, 1900, against the Buffalo Gasoline Motor Company, and the second immediately thereafter against the Winton Motor Carriage Company of Cleveland.

The Buffalo company had been selected as a manufacturer of parts; the Winton company as a maker of cars. In addition, there were strategic reasons for choosing the latter as a target. Alexander Winton, as we have seen, was at this time the most prominent holder of speed and endurance records in the country, and the most vigorous advertiser of gasoline cars for family use. He was producing more automobiles than any other manufacturer, for Olds had not yet attained quantity production. He was the logical bellwether of the flock. If Selden and the E. V. C. could once tame him, the rest of the industry might follow with docility. That he was selected is proof of the confidence the patent-holders had in their case.

Prior to the first court actions the Columbia & Electric Vehicle Company had transferred its patent rights to the Electric Vehicle Company, which had been reorganized as an $18,000,000 corporation controlling the Columbia & E. V. C. and the New Haven Carriage Company, with Day as president. The suits were brought jointly by it and George B. Selden.[15] Three additional suits were later filed: one on December 27, 1900, against the Automobile Forecarriage Company, a second on January 10, 1901, against the Ranlet Automobile Company, and the third on January 11, 1903, against the importing firm of Smith & Mabley.[16]

Motor Age redoubled its efforts to unify the industry, the editor writing to both the Winton and Buffalo concerns, who welcomed his help. Meanwhile, George H. Brown, treasurer of the Winton Company, announced that it meant to fight. "The Selden patent is preposterous, and should never have been granted by the patent office. It will not have a leg to stand upon when it gets into the courts."[17] A defense association was actually formed on August 2, when twenty firms met at the Iroquois Hotel in Buffalo and established the Hydrocarbon Motor-Vehicle Manufacturers' Association. Elmer Apperson of the Haynes-Apperson Company was elected president. Besides the Haynes-Apperson, Winton, and Buffalo firms, the Autocar Company and the Charles Duryea Power Company of Reading, Pennsylvania, were among the independents who joined in the alliance. The members then being sued pledged themselves to make no compromise in the litigation.[18]

Unfortunately, the association formed to unite the industry never became really active, and did not come to the support of the smaller companies. The Ranlet organization submitted to a decree *pro con-*

fesso on May 21, 1901, acknowledging the validity of the patent, and the Automobile Forecarriage Company followed its example on May 27. Both settlements provided the patent-holders with ammunition to frighten other independents. Neither the Buffalo Gasoline Motor Company nor Winton Motor Carriage Company at first weakened. The latter received a sharp setback on November 9, 1900, when Judge Coxe overruled a demurrer which it had filed; but both suits nevertheless continued. In the Winton case a stout attack was made upon the patent by experts, witnesses, and exhibits, the defense testimony alone filling 1400 pages.[19] However, as early as November, 1902, the Winton officials seem to have considered the possibility of negotiating a settlement. Hearing that seven automobile manufacturers had applied for licenses, they consulted with their attorneys upon the effect of this development on their case in court, and were advised to seek favorable terms.[20]

Such terms they easily obtained. The Winton Company was not asked to pay royalties on production prior to the settlement, and was permitted to deduct from future payments an amount sufficient to recompense it for the costs of the suit. Other manufacturers who had assisted Winton in the litigation were to be reimbursed in a similar manner if and when they surrendered.[21] Before the settlement was completed a further point was agreed upon: an association of licensed manufacturers would be established which would offer certain advantages to all who paid fees. A group of Detroit manufacturers played an important role in establishing this organization.

According to F. L. Smith, then secretary and treasurer of the Olds Motor Works, a representative of the Electric Vehicle Company came to Detroit early in 1903. He reported that Winton would acknowledge the validity of the patent, and invited the chief Detroit firms to follow his example. Ten manufacturers thereupon met and discussed the E. V. C. proposals which, Smith writes, required payment of a royalty of 5 per cent on the retail price of each car sold. This and other details were unacceptable to the group. They subscribed $2500 each as a potential war fund, delegated the task of negotiating with the Selden group to five of their number, and then departed to the annual Automobile Show at Madison Square Garden in New York. The five negotiators were Clifton (of the Pierce Company), Cutler (Knox), Davis (Locomobile), Packard (Packard), and Smith.

When these men arrived at the Show, Whitney invited them to an informal meeting at his Fifth Avenue residence. "This was a strategic mistake of the enemy," Smith recalled. "Neither the urbanity and courtesy of Mr. Whitney nor his evident sincerity and straightforwardness could offset the bad effect of proposing to shear us sheep in a New York drawing room. Straightway we became rams, mules, lions, if you like, charging bulls, with $25,000 real money." Before they went, they appointed Cutler as their spokesman. He had jotted down their terms on an old blue envelope which he kept available for reference during the ensuing conference. The terms which the five westerners had agreed upon were as follows:

> First.—We will pay one and one-fourth per cent royalty, three-fourths of one per cent to the Electric Vehicle Co., one-half of one per cent into an association of our own.
>
> Second.—This association shall say who shall or shall not be sued under the patent.
>
> Third.—It shall say who shall be licensed and who shall not be licensed under the patent.

Whenever Whitney or Frederic Betts of the E. V. C.'s legal staff tried to draw out their visitors, they would refer any question asked to Cutler, and on each occasion Cutler would patiently re-read the three points he had jotted down. In the end the points were accepted by the patent representatives, and the Association of Licensed Automobile Manufacturers was born. The Winton Company on March 5 signed a typewritten copy of an agreement which was then printed and signed as of that date by the others. Thus, as Ford's chief attorney was to put the matter in 1909, "the Electric Vehicle Company . . . assigned over to the Winton Company . . . and its associates, *entire control of the patent*."[22] Actually, the E. V. C. collected the fees or royalties, then paid ⅖ of them to the A. L. A. M., retaining ⅖ itself and sending ⅕ to Selden.[23] Of what he received, Selden was said to have paid half to George H. Day.[24]

Either as a part of this settlement, or by a later arrangement, the Winton attorneys, Kenyon & Kenyon, were retained by the E. V. C. at an annual fee of $5000.[25]

All was now ready for the public closing of the suit. On March 20, 1903, Judge E. H. Lacombe issued a decree *pro confesso*. The de-

fendants conceded the validity of the patent. An accompanying stipulation provided that "this decree be without cost to either party as against the other." Finally, all testimony and exhibits were withdrawn from the court records "and delivered to the solicitors for the complainant"—that is, to Betts and Sheffield. They never again appeared in public records, although efforts were made to obtain them.[26] Winton and his allies were fairly well satisfied with the result. They were to recover costs, pay no back royalties, and through the new Association control both licensees and possible suits. F. L. Smith, one of their group, was elected president of the A. L. A. M. They could count on suppressing fly-by-night concerns which might discredit the automotive industry.[27] The royalty they paid was small, and almost half of it went into A. L. A. M. coffers, to be used for "the good of the industry." *

However, Selden and the E. V. C. were even happier. Their patent had gathered greater prestige, and they could now count on a steady income from a score of manufacturers. As manager of the A. L. A. M., George H. Day kept a finger on all developments. Less than three years before they had faced an industry which rejected their claims; now a strong bloc were their allies. The bellwether had come to them and a big part of the flock had plunged after him! Why should not the separation of sheep and goats continue until all the desirable firms had been absorbed and the undesirables had been crushed?

3.

When Henry Ford began to talk with Malcomson in the summer or early fall of 1902 about his "family car," he knew something about

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* The most enduring work of the Association of Licensed Automobile Manufacturers was performed in its capacity as a trade association, and by the Mechanical Branch it organized in 1905. Automotive engineers and production superintendents of A.L.A.M. member firms were brought together at the branch's regular meetings for a free exchange of fundamental knowledge [illegible] ycle [illegible] each [illegible] ers [illegible] A.M. [illegible] Branch, *A.L.A.M. Digest of Current Technical Literature: Automobile*, Vol. XVI, No. [illegible] in 1910, [illegible] n of an [illegible] contribu- [illegible] Although [illegible] produc- [illegible] ass pro-

the patent combination and the Winton suit. Not only were both mentioned in *Horseless Age,* which he read, but he had also received reports on the litigation from a firm of Detroit lawyers, who reported to him specifically in November, 1900, on the overruling of the demurrer by Judge Coxe.[28] Nevertheless, his attitude toward Selden's patent must have been skeptical. Motor cars had been made for sixteen years, he himself had been building them for six, and hundreds of others were constructing them. Could what had so long been a free activity suddenly come under the legal control of a small group?

After the settlement of the Winton suit on March 20, 1903, and the announcement of the formation of the A. L. A. M., the patent took on a much more formidable appearance. Should it not have caused Ford and Malcomson to consider submitting?—would it not discourage men like Gray, Anderson, Rackham, and Bennett?[29] Apparently it did. Writing to Charles B. King in 1936, Herman F. Cuntz stated that Ford discussed with him an application for a license in Chicago in February, 1903.[30] Cuntz was then working with the E. V. C., and had doubtless assured Ford that the Winton suit was being settled. No evidence appears in this slight though definite reference that Ford had done more than re-explore the situation, but even this is significant.

In June or July Ford seems to have turned again to the question of getting his company licensed. As we have seen, Fred L. Smith of Olds was acting as the president of A. L. A. M., and offered an authoritative source of information. Both W. J. Cameron and Edsel Ford said years later that Henry Ford approached some A. L. A. M. official. Smith stated that it was he, and his account of the meeting agrees in the main with Edsel's.[31] "Henry Ford called on me one morning long ago," runs the account Smith wrote in 1928, "and wanted to know if, in case application were made, membership in the association would be granted them. Not as the exalted president of the A. L. A. M., but as one man to another, I told him I did not think an application from the Ford Motor Co. at that particular moment would be considered favorably. . . . I remember solemnly telling Henry Ford that his outfit was really nothing but an 'assemblage plant'—poison to the A. L. A. M. [actually many of its own members still had that character, and none made machines without drawing for some elements on parts dealers] and that when they had their own plant and became a factor in the industry, they would be welcome, because, among other reasons, the

type of car they were then making was not being turned out by any of the A. L. A. M. members."

While Smith was unjust in belittling the new company as a mere "assemblage plant," he knew of the failure of the Detroit Automobile Company and Ford's break with the Henry Ford Company, and was justified in feeling that the future of this new venture might be shaky. However, his advice to delay action must have excited resentment. Ford had a much longer experience in the automotive world than Smith, was conscious of no debt to Selden, and would never have accepted an estimate of his organization as inferior. We may be sure that whatever he said to Smith, he later spoke his mind to his associates with sulphurous vehemence.

Apparently Gray and Anderson, however, favored further negotiation. Smith says that soon after his meeting with Ford, Anderson invited him to luncheon at the old Russell House, where he found Gray, Ford, and other stockholders waiting for him. Gray explained the plans of the Ford Motor Company and expressed surprise that Smith regarded it as an undesirable candidate. Smith was ill at ease. "Mr. Gray put their case so fairly and simply that I had a guilty feeling of 'sassing' my elders and betters when I, in turn, tried to state the A. L. A. M. policy and purposes. . . . I was conscious of cutting a rather sorry figure before a group of friendly men who put me personally in the wrong by dealing with me officially." However, the awkwardness of the occasion was lessened by the fact that no specific application was made, and Smith did not have to repeat his recommendation of delay, which he would have done if pressed.[32]

Perhaps he liked to recall the luncheon as less explosive than it actually was. In *Men, Money, and Motors* Theodore F. MacManus and Norman Beasley give a more dramatic account of what seems to have been the same meeting:[33]

> Smith was there for the purpose of whipping the company into line. He presented the case of the Selden backers, as well as the position of the association, and sat down to await an answer.
>
> It came:
>
> "Selden can take his patent and go to hell with it!" roared Couzens.
>
> Ford, who had been dangling in a chair tilted against the wall, rapped out: "Couzens has answered you."
>
> "You men are foolish," counselled Smith. "The Selden crowd can put you out of business—and will."

Couzens laughed unpleasantly. Ford, standing up, pointed a finger at Smith and cried:

"Let them try it."

The meeting broke up.[34]

The Ford stockholders were undoubtedly angered, just as Smith and his associates had been angered by Whitney and Day some months earlier in New York. By the very nature of the A. L. A. M., Smith was placed in the attitude of a polite man with a bomb in his hand telling a group that he had the right and power to destroy them. No amount of pleasantness in his manner, no assurance that he did not intend to throw the bomb immediately, could alter the essential situation. Nor was Smith's position in dealing with Ford and Couzens improved by the fact that, as they knew, he was the son of a rich man who had bought the Olds Automobile Company for him. Anxious to ascertain their chances of fighting a successful battle against the patent, Ford and Couzens turned to the most eminent of Detroit's patent lawyers, Ralzemond A. Parker of the firm of Parker & Burton; a man of long experience—he was sixty years old—and high reputation. Parker, a veteran of the Civil War who had fought at Antietam, had been graduated in 1872 from the University of Michigan Law School, had served as a judge, and had then specialized in patent law, gaining a brilliant series of victories. A ruddy, graying, bearded man above medium height with a resemblance to James Russell Lowell and a burly set to his shoulders, he must have disconcerted many a witness with the searching glance of his intent gray eyes.[35] He knew patents and the ways of patent courts as well as any lawyer in the United States. If the Selden patent was a deception, Parker could be depended upon to puncture it.

As an alert attorney who followed the principal cases in his own field, Parker must already have been aware of the patent and may even have examined it. He had an instinct for mechanics which was almost a requisite for his field, had acquired and operated a steam-driven car, a Locomobile, long before the Selden patent became a threat to Ford, and had seen not only his son but a daughter undertake engineering as a profes[illegible] Ralzemond D. Parker, [illegible] "Henry Ford wen[illegible] mobile industry." [illegible] instinctive loyalty [illegible] believed in justice for the little fellow. [illegible] The Selden case attracted

him at once; and as soon as he was retained he leaped to battle with the vigor of a man in his twenties.

On July 26, 1903, the Detroit *News* published a two-column advertisement, signed by the Association of Licensed Automobile Manufacturers, 7 East Forty-second Street, New York:

NOTICE

To Manufacturers, Dealers, Importers, Agents and Users of
GASOLINE AUTOMOBILES.

This advertisement called attention to the Selden patent, characterized the twenty-six firms then licensed under it as "the pioneers of the industry," and gave the following warning:

> No other manufacturers or importers are authorized to make or sell gasoline automobiles, and any person making, selling, or using such machines made or sold by any unlicensed manufacturers or importers will be liable to prosecution for infringement.

Some justification could be offered for calling the Association members "pioneers of the industry," for the J. Stevens Arms and Tool Company (with Frank Duryea), the Olds, Haynes-Apperson, Apperson Brothers (Haynes and the Appersons had parted and established separate enterprises), Winton, and Pope (the Pope Motor Car Company and Pope, Robinson Co.) companies appeared in the list, along with such other well-known organizations as the Electric Vehicle Company, the Packard Motor Car Company, the Autocar Company, the George N. Pierce Company, the Locomobile Company, the Peerless Motor Car Company, the H. H. Franklin Manufacturing Company, and the Cadillac Automobile Company.*

This was the first A. L. A. M. advertisement in a Detroit paper, although ten days earlier "Trade Talk No. 1" had been sent out with copies of *Automobile Topics,* and probably had come to the Ford plant. To Ford and Couzens the advertisement would have been far more alarming than the trade talk. As previously related, they were supposed to have seen it while loading a shipment of cars—"coats off, collars unbuttoned, sleeves rolled up."[27] After looking at the ad, they

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* The Northern Manufacturing [illegible] the E. R. Thomas Motor Company, t[illegible] pany, the Waltham Manufa[illegible] & Voigt Co. of America (S[illegible] mobile Company, and the [illegible]

calmly went on with their work. The Ford Motor Company replied to this particular advertisement two days later with one of its own in the *Free Press* which ran:

NOTICE
To Dealers, Importers, Agents and
Users of our Gasoline Automobiles,

and promised: "We will protect you against any prosecution for alleged infringements of patents." It quoted Parker, whose comment even at this stage showed a precise understanding of the points at issue. "The Selden Patent is not a broad one, and if it was, it is anticipated. It does not cover any practicable machine, no practicable machine can be made from it, and never was, so far as we can ascertain. It relates to that form of carriage called a FORE Carriage. None of that type have ever been in use; all have been failures." And again: "No court in the United States has ever decided in favor of the patent on the merits of the case; all it has ever done was to record a prior agreement between parties." The advertisement closed on a note of defiance:

> We are the pioneers of the GASOLINE AUTOMOBILE. Our Mr. Ford also built the famous "999" Gasoline Automobile, which was driven by Barney Oldfield in New York on July 25, 1903, a mile in 55 4/5 seconds, on a circular track, which is the world's record.
>
> Mr. Ford, driving his own machine, beat Mr. Winton at Grosse Pointe track in 1901. We have always been winners.

The A. L. A. M. gave no evidence of the effect of this blast, but continued its efforts to persuade the industry and public alike that the Selden patent was valid and could not be infringed with impunity. Their advertisements appeared regularly. Propagandist bulletins assured manufacturers that the Association would eliminate irresponsible firms and otherwise stabilize the industry. Buyers were warned to shun non-licensed machines. "No sensible man wants to buy into a lawsuit," counselled *Automobile Topics*.[38] Selden himself gave an interview which was published in the Hartford *Daily Courant* of August 31, and later distributed widely as a reprint, apparently by the A. L. A. M. The men who boldly talked about organizing the independent manufacturers and providing a fund to indemnify firms sued by the E. V. C., he said, were pursuing a dangerous course. "No guarantee can be given by any individual, firm or corporation against

an injunction of a Federal court. We now have six good and sufficient grounds on which the court would award an injunction—viz., five decrees and the public acquiescence—90 to 95 per cent. of the trade having taken licenses under my patent. . . . In truth, on a motion for a preliminary injunction on my patent as it now stands, the only question the court would consider would be that of infringement. . . . The courts will not waste their time by permitting the discussion of matters already thoroughly settled by their decisions."[39]

This was going far! It was an attempt to create the impression that the patent had already been validated, which of course was not the fact at all. The moment was crucial, and Selden's statement held a threat of further legal action on the part of the Selden group. Whom would they strike? Most observers would not have said the Ford Motor Company; their choice would probably have been the Thomas B. Jeffery Company, makers of the Rambler car, whose head was known to be tough, independent, and powerful. However, the Ford officials exerted a direct influence upon the situation.

Though Parker seems to have begun investigating the Selden patent in late June, it was not until September 17 that President Gray invited the Ford stockholders to a meeting the following day to hear the lawyer's considered opinion. He told them they could successfully oppose the patent. They placed the entire matter in the hands of Ford, Rackham, and Parker for further consideration and action; and intensified action soon came.[40]

Advertisements by the A. L. A. M. were matched by the Ford Motor Company in the *Cycle & Automobile Trade Journal* (see issue of October 1, 1903), *Horseless Age*, and other publications. The Ford officials thus took the lead among independents in flinging a glove into the face of the trust. In addition, a letter dated September 24 also appeared in chief automotive publications. Though it bore signs of Parker's editing if not authorship, it was signed by Couzens as secretary of the Company.

The letter was devastatingly complete in its attack on the A. L. A. M.'s pretensions and policy. Announcing a determination "to manufacture and sell all of the gasoline automobiles of the type that we are constructing that we can," it asserted that these machines in no way infringed upon the Selden patent. Indeed, it declared, Selden had contributed literally nothing to automotive development. "We cannot

conscientiously feel that Mr. Selden ever added anything to the art in which we are engaged. We believe that the art would have been just as far advanced to-day if Mr. Selden had never been born." The letter referred to the Hartford interview, which it denounced as "absolutely false." It discussed patents, pointing out that while the A. L. A. M. claimed to control 400, between 2000 and 2500 had been granted covering "various branches of this industry." It dryly adverted to Selden's claims that his licensees were making upwards of 90 per cent of all gasoline automobiles: "We are not now in a position to state whether this is true or not, but we are endeavoring to do our level best to reduce the per cent." Finally, it announced its readiness to defend any suit brought against the Ford Motor Company, asserting that all the previous defenses which had been compromised were still good, and promising to strengthen and extend them.

The letter was an attack and a taunt. The importance of the Ford Motor Company was enhanced by its defiance. Would Ford and Jeffery combine? Or would Jeffery, as the more powerful organization, be selected? His company had issued a statement that it would protect users of Ramblers against any action by the A. L. A. M.[41] But Jeffery's attitude had been one of passive resistance, while Ford's was one of attack. Ford was quoted later as saying he "would give the 'trust' $1000 if they would commence suit against him," believing that the publicity would be worth many times that.[42] Doubtless Ford also liked the role of a free American opposing the "trust."

This challenge left but one way out for the patent-holders. They would have been laughed out of the industry if they had not gone to court. Still, it must have been humiliating to them, after a long and lively propaganda campaign designed to capture control by threats, to be literally dragged to an encounter by a supposedly feeble opponent.

4.

On the part of the Ford stockholders, the struggle had not been lightly undertaken. An official, probably Couzens, told a reporter from the Detroit *Journal* two days after the filing of the suit: "It may take years to thresh the matter out in the courts." He added that they would enlarge their factory and multiply their 1903 output by five. "We have no apprehensions as to the result of this suit."[43]

The trade fully agreed with him as to the gravity and probable dura-

tion of the contest. *Automobile,* stating that the litigation would be protracted, added: "It was doubtless against the hardships of delay that many of those who are now members of the Licensed Association sought refuge when they joined it."[44] *Horseless Age,* pointing out that the suit was the sixth brought, and that all the others had been compromised, observed that "the previous attitude of the defendants in this suit makes this [a settlement] rather unlikely."[45] Automobile men and the public settled back for a long wait. They realized what the outcome might mean if Selden were victorious. "A judicial upholding of this patent," declared *Automobile,* "would entitle those who control it to have every unlicensed gas motor vehicle in the land battered to pieces by officers of the law and destroyed, whether found in the possession of manufacturers or innocent purchasers."[46] *Horseless Age* pointed out that even those holding foreign cars would infringe.[47]

The suit soon became five suits. The O. J. Gude Company, which had purchased Ford cars, was brought to court on November 5; on December 28 complaints were filed against two foreign firms, Panhard et Levassor and André Massénat; in May, 1904, suit was brought against the Wanamakers, Ford agents in New York; and in November, 1904, Henry and A. C. Neubauer, two Dutch importers whose central offices were in Paris, were made defendants for having sold Panhard and Renault automobiles in the United States.[48] Eventually these actions were all merged for purposes of judicial decision, although the complainants insisted on separate testimony being taken in the case of the French firms—an act which greatly augmented the mountain of material dumped before the judges.

An imposing array of counsel were retained. For the complainants Betts, Betts, Sheffield & Betts, and Redding, Kiddle & Greeley, both of New York, handled the case. William A. Redding and Samuel R. Betts were the most active representatives, although at various times other spokesmen of the two firms appeared—John W. Peters, George Raines, Ramsay Hoguet, James R. Sheffield, and Frederic H. Betts. Frederick P. Fish of Fish, Richardson, Herrick & Neave took an active part in preparing the briefs and in the final oral argument. The three leading attorneys held eminent places at the New York Bar. Fish was a handsome, distinguished-looking man, shrewd, poised, and eloquent —"probably the best attorney in the United States," Frederic R. Coudert later declared.[49] He was a Harvard graduate, an expert in patent

law, and from 1901 to 1907 president of the American Telephone & Telegraph Company, resigning to resume private practice. Betts, a tall man with a white mustache, and Redding, tall and very lean, with a Van Dyke beard, brought high ability and great prestige to the case.

For the Ford Motor Company, Parker shouldered all the active trial work, although William L. Eaton made occasional routine appearances. However, Parker had the advantage of association with Cardozo and Nathan, who acted as solicitors for the American defendants.[50] He also shared with the Panhard counsel the benefit of the advice of George H. Benjamin, a consulting engineer and a patent expert. Within his own firm he had an able assistant in Elliott J. Stoddard, who later testified for the defence on technical matters. Stoddard was both a patent lawyer and an expert on gas and gasoline engines, with practical experience.[51] Parker paid frequent visits to the offices of Coudert Brothers, and may have obtained some minor assistance from them.

For Panhard, Massénat, and the Neubauers, the well-known firm of Coudert Brothers were the counsel. John P. Murray of their staff was the trial representative, examining witnesses, conducting cross-examinations, and attending to the vast amount of research necessary. He undoubtedly leaned on Parker, who, as Coudert later asserted, "knew more than anybody about the Selden Patent Case"; but he also owed much to Frederic R. Coudert both in maintaining close relations with his clients, and in organizing the final briefs. Coudert made an oral presentation, and rendered other important services, though he was not a patent attorney. The grandson of a French emigré who came to America in 1823, he was half French by blood and spoke the language of his Parisian clients fluently. This fact was later to be of important service to Ford.

The Selden Patent Case was a suit in equity, conducted in a routine and wholly undramatic fashion. No exciting courtroom scenes pro-[illegible] was taken [illegible] Lansing, [illegible] witnesses [illegible] were asked to appear for examination. Sometimes they testified before notaries public, but usually before examiners approved by the court. Counsel for both sides were present. The examiner kept order, saw that a proper record was made, and granted delays; but he had no authority to

on objections, which were frequent, or to compel a witness to be "responsive." In the absence of a court official with full powers, attorneys naturally put in all the evidence they thought might be effective, while their opponents objected with frequency and vigor to impugn as much of the case as they could. An objection having been made, the witness answered, and the judge was supposed to make his own decision as to the character of such testimony.

The result was a Himalaya of evidence, amounting with the exhibits and briefs to more than 14,000 pages and 5,000,000 words. The exhibits alone—photographs, printed articles, patents and attendant charts and drawings, catalogues, leaflets—filled five volumes when the record was later printed for appeal. The mass and character of the material accumulated was to be influential in changing the procedure in future patent suits, most of which today are tried in open court, with a judge ruling on objections and excluding irrelevant material. Meanwhile the Selden suit dragged its way through eight long years. Yet if the case was not dramatized in day-to-day reports for newspaper readers, it nevertheless had its arresting aspects.

The persons involved were often striking figures, from Selden and Ford, who became opposing symbols in the struggle, through a large group of automotive pioneers like Charles Duryea, R. E. Olds, Elmer Apperson, Jonathan Maxwell, and Hiram Percy Maxim. The ghost of Brayton haunted the examinations, his widow, Mrs. Rhoda Paulman, and various associates and customers stepping out of the past. From Paris came Arthur Constantin Krebs of Panhard, from London Dugald Clerk for the complainants, from Cornell Professor Rolla C. Carpenter for the defense. Officials and members of the A. L. A. M. took the stand. Finally, two startling exhibits were brought forward which symbolized the opposing claims and made headlines in the newspapers.

As the trial advanced the contesting parties conducted much of their battle outside the courtroom. If the public lacked play-by-play reports of the judicial process, it was not left in ignorance of what developed, and a certain amount of obscurity only sharpened its feeling of suspense.

5.

Selden's counsel opened hostilities in a relatively routine manner. Their task was to prove infringement and support the legality of their

patent. Accordingly, their first witnesses testified to the sale or purchase of cars by the defendants, to the status of the Electric Vehicle Company in relation to the license, and to the payment of license fees by A. L. A. M. members. Edward M. Bentley gave the most extended and varied testimony in this first presentation. As an engineer and expert, he explained the character of the Ford car, checking this against the patent to demonstrate violation. The remainder of the complainants' case, a full volume in the printed record, consisted of exhibits selected to prove the character of the patent and its infringement by the defendants. All their direct evidence in the Ford cases, which was completed by the first half of the year 1904, filled only two rather brief volumes. The complainants had other ammunition, but were holding it in reserve. They wanted to see what attack Parker would make on the patent; then they would open with their big guns. Meanwhile, it was Parker's task to destroy the case that had been put forward.

The attorney approached this task with a number of purposes in view. One was to expose the character and methods of the Electric Vehicle Company and the Association of Licensed Manufacturers, Selden's allies. Another was to establish firmly the character of the "prior art"—that is, the patents, devices, and machines which antedated Selden's application of 1879. If he succeeded as he hoped, he would prove that no invention was involved in Selden's claims. This established, he could attack the patent, showing that if broadly construed it was worthless, and if narrowly construed was a patent on Selden's modification of the Brayton engine, and on that alone. Parker also proposed to demonstrate that the patent's original terms had been altered with the hope of covering the developments that occurred in the 1880's and early 1890's.

Parker had little cross-examining to do in reference to the complainants' primary case, except where Edward M. Bentley was concerned. However, in his handling of Bentley he showed what might be expected when the opposition brought Selden and Clerk, their big guns, to the witness stand. Parker quickly demonstrated that Bentley had a limited knowledge of automobiles. He had driven an electric, but never a gas machine, and confessed that he was not versed in the "prior art." Parker proceeded to question the engineer on almost every conceivable aspect of the engine and carriage as described in the patent. He took up the phrase "my improved liquid hydrocarbon engine."

Did this phrasing mean that a particular engine was envisaged? Bentley was aware that Selden wanted to cover all engines, and edged away from such an admission. He thought it was just an "awkward way" of referring to any hydrocarbon engine. Then, asked Parker, why were "my" and "improved" included? Bentley couldn't say. "Well, is it your understanding that they are synonymous with and mean 'any old?'" Bentley hastened to deny that. Well, persisted Parker, how did the engine differ from predecessors? "I have not undertaken," Bentley at length replied rather miserably, "to say anything in regard to the prior state of the art and the degree of novelty."

Essentially the same performance was repeated time and time again. Parker discussed Selden's phrasing. He wanted to know exactly what was meant in each instance. What was "liquid hydrocarbon," for example? Would crude oil do? If not, what was meant? What was "flame ignition"? Could it be outside the cylinder? Inside? Thus they followed a kind of anguished dance (on Bentley's part) for days. While Parker was laying the foundation for an attack upon the character of both engine and carriage, Bentley was making a number of statements that he would later try to modify or virtually deny. Betts and Redding could not let his performance stand.[62]

Parker began his own case in Detroit on July 20, 1904, with Henry Ford as his first witness, and after producing Stoddard, Huff, and others, shifted to Reading, Pennsylvania, Boston, Providence, Pittsburgh, Lansing, Ithaca, and New York. His witnesses were in part automobile pioneers like Duryea and Olds; another group represented testimony on Brayton's experiments with boats, streetcars, and buses; and finally such experts as Professor Carpenter of Cornell and Jesse M. Smith of New York testified on engines and patents, discussing inventors who were alleged to have anticipated Selden, and the character of Selden's machine. In examining the automotive pioneers like Ford, Olds, and Duryea, Parker brought out the use of various devices in Selden's carriage prior to 1879 (the clutch, the steering mechanism, the gears), and showed the development of the automobile in the 1880's and 1890's, emphasizing that neither motors nor carriages borrowed anything from Selden.

The defense also presented an impressive body of testimony upon the activities of Brayton. His widow testified to his plans for using his engine in the propulsion of vehicles, as did various associates who knew

his work, and two customers, J. F. and W. J. Fawcett, who experimented in Pittsburgh first with a regular Brayton engine to be used in an omnibus, and then with a lighter one especially adapted to their purpose. The vehicle ran, they declared, but city authorities forbade its use.[53]

The exhibits presented by the defense were as formidable as the testimony. They included hundreds of patents in "the prior art" (that is, granted earlier than the filing of Selden's application of 1879), with drawings of devices and machines; data on the Brayton engines; documents, advertisements, and publicity on the E. V. C. and A. L. A. M. and their activities, and much other material.[54] Later the exhibits by both parties to the suit were augmented, the defendants profiting by material brought from France in connection with the Panhard suits. Such exhibits, together with the testimony of pioneer witnesses, made the Selden suit an important source for automotive history.

Betts and Redding now brought up their heavy artillery in the form of rebuttal to Parker's evidence. One group of witnesses gave their testimony in Rochester. Some, like William Gomm, the mechanic who had worked on Selden's motor in the 1870's, deposed as to his employer's hopes, plans, and accomplishments as an automotive pioneer. Another group brought a striking exhibit into the trial.

This was the Selden "buggy," a motor carriage built under the supervision of Selden's sons to demonstrate that a car constructed in accordance with the specifications of the patent would actually run. Several Rochester men asserted that they had seen it do so. Later this vehicle, known as Exhibit 89, was introduced by the complainants along with another, Exhibit 157, which had been constructed by the Electrical Vehicle Company under the direction of Henry Cave, one of their engineers. Selden hailed both as "Chinese copies" of what he had envisaged in 1879, but liked to think that the machine built in Rochester came a little nearer to the prescription he had given.[55]

Parker objected vehemently to the introduction of evidence by Rochester witnesses about Exhibit 89, pointing out that no defense counsel had been notified of its trials or given an opportunity to witness them. "Personally I don't believe that Exhibit 89 . . . ever ran 10 rods!" he snapped later in a moment of exasperation.[56] Naturally he demanded that tests of one or both machines should be made in the presence of defense experts, who should have full opportunity to

examine the exhibits. A Court order was issued to this effect on March 30, 1907, the Selden group having meanwhile permitted Dugald Clerk to observe Exhibit 157 in action and to make tests of its motor, activities of which defense experts were only spectators.[57]

As to Selden's motor built prior to the application for the patent, Parker was able to establish that it was not the three-cylinder machine shown in the patent itself, but a one-cylinder affair. While one witness thought it had run as long as half an hour continuously, Parker was able to prove by Gomm that the maximum performance had been about five minutes.[58] At best, the testimony of the Rochester witnesses showed that Selden possessed some mechanical ingenuity, had built a rather ineffective motor, and had laid plans for a new car which he discussed with friends.

Another group of witnesses consisted of E. V. C. and A. L. A. M. officials brought forward by the complainants to show the beneficent character of these organizations. Parker enjoyed examining these officials, who were not always uncooperative. Thomas Henderson of the Winton Company, for example, testified frankly as to the employment of Kenyon & Kenyon by the E. V. C., and the delivery of the case records and exhibits to the Betts office after the settlement. When Parker asked concerning this latter act, "Was it with the understanding that the suppression of such testimony and exhibits . . . would make it more difficult and more expensive for any person sued for infringement of that patent thereafter to conduct the defense?" Henderson responded: "That wasn't discussed, but undoubtedly that was the purpose."[59]

A certain amount of light is shed upon the fate of these records by Kurzel-Runtscheiner's *Siegfried Marcus,* in which it is brought out that in 1900 Viktor Tishler, Marcus's former patent attorney, dispatched a bundle of documents substantiating Marcus's claims to have developed an operative automobile with a four-cycle engine in the 1870's to the New York office of Richards & Cie., for use in defending a patent action brought by the Association of Licensed Automobile Manufacturers—probably the Winton suit. These were never returned, and it is possible that they were among the materials turned over to Betts by Kenyon & Kenyon. While, as we shall see, Murray on behalf of his Panhard and Neubauer clients was prepared to present evidence as to

the effectiveness of the Marcus carriage, both he and Parker might profitably have studied Marcus's own records, although the exact character of these is now unknown.*

Other A. L. A. M. personnel were not so cooperative as Henderson. Milton J. Budlong, president of the organization, sought to deny any monopolistic character, but Parker was able to establish from his testimony that the Association reserved the right to reject automobile manufacturers, and that the restriction of membership or of licensing with the purpose of lessening competition was an A. L. A. M. objective.[60]

Dugald Clerk was intended to be the trump card in the complainants' play. This able Scot was a member of the Institution of Civil Engineers, a Fellow of the Society of Industrial Chemistry and the Chartered Institute of Patent Agents, a member of the Royal Institution and other scientific organizations. He was the inventor of various engines and the author of widely-used books, particularly *The Gas Engine* (1886) and *The Gas and Oil Engine* (1896), while he lectured on internal combustion motors and other aspects of automotive development. His eminence was incontestable.[61] Yet in some ways this very eminence of Clerk worked for the astute Parker. Clerk was prepared to support his favorable opinion of the patent. On the other hand, his integrity and innate honesty did not permit him to evade searching questions, or to make his favorable verdict too sweeping.

He had a respect for Parker's insistence on precision and accuracy, for these were gods he himself had worshipped. So he would answer "yes" or "no" when Betts and Redding must have wished that he would equivocate, and he would concede possibilities which modified his general opinion, or even laid it open to confutation. Thus he identified Selden's engine as of the Brayton type (a classification Parker wished to establish), he agreed that all the chief devices in the carriage described in the patent had been well known in prior art, and he conceded that with certain favorable interpretations Rosenwald's French patent of 1877 represented an operable machine and thus anticipated Selden. In one instance he opened up a rather helpful possibility for the defense. He was emphatic in asserting that Lenoir could not have built an operable car in the 1860's because the Frenchman used a non-

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* Erich Kurzel-Runtscheiner, *op. cit.*, 30. It might be argued that the documents were still retained by Richards et Cie. in 1904, but this seems highly improbable. Coudert would have obtained them. Betts and Redding doubtless argued that the destruction or suppression of such evidence was a duty to their client.

compression type of liquid hydrocarbon motor, and no such motor could have propelled a vehicle. He conceded that had it done so, Selden's claim to a broad patent might have to be re-examined. We shall soon return to that admission.

Clerk himself was worried about his performance—a highly expensive one financially for the prosecution, for he was paid well, and remained on the stand for days. "If Mr. Parker is right as to the American patent law," a reporter heard him say, "I fear I have broken down the case of my side."[62]

With Selden, Parker had a more difficult time. The two men made fascinating opponents. In many ways they resembled each other. Each was a descendant of Puritan ancestors who had settled in Connecticut in the 1630's. Each was a Civil War veteran, each a patent lawyer. Both were men of ripe experience; Selden was sixty when he appeared as a witness, Parker at that time was sixty-three. Both were strongly partisan, both astute and able. In physical appearance they differed. Selden was of medium height, lean, and active for his years, with gray mustaches and steely eyes; Parker was bearded and burly. If Selden was the greyhound type, he was the bulldog; if the Rochester attorney was leopard-like, Parker was a watchful, shaggy lion.

Selden had a touch of arrogance. At some time after 1903 he began to use a tie-pin with a replica of his "buggy" and he was confident of victory throughout the case. He had not intended to take the stand. However, after the defense case was made, his attorneys probably decided that he must—that his story had a romantic appeal and that while pretending to no expertness in the engineering field, he would actually bolster their case technically. But they particularly wanted him to build up the stature of the patent with autobiographical material. Selden met their desire in an effective way. He described his interest in horseless carriages and the steps by which he developed his engine and his car, supporting his account with excerpts from his notebooks and letters. It was a sincere recital, and it was good theater. Parker objected to it as not proper rebuttal testimony, but as there was no judge to rule on that point, Selden completed his account.

However, once beyond this stage of the testimony, Parker was on his own ground. He relentlessly brought out the meager mechanical work that Selden had done up to 1879. He forced the Rochester lawyer to admit that except for a few parts used in the engine of Exhibit 89,

nothing in that machine or Exhibit 157 dated more than a few years back. He tried to compel Selden to define precisely any features of his motor that were new in 1879. He took up such details as the relationship of the speed of the crankshaft to that of the propelling wheel. Selden had said the crankshaft was faster. Would a ratio of 101 to 100 meet this description? No? Two to one? The witness thought not. Three to one? "I have not tried it." Parker demanded: "Have you given the public any information whatever in your patent as to what ratio of speed of the crankshaft relative to that of the propelling wheels they must have, in order to secure the new and useful results which you have specified?"[63]

Selden, however, would not be pinned down in such a fashion. He insisted that the patent and the drawings together (although Parker had shown that these indicated a two to one or three to one ratio) gave sufficient information. In general, he countered Parker's insistence on the specific with explanatory statements, sometimes pages in length, emphasizing only such points as he himself wished to make. Indeed, he avoided all demands for yes-or-no replies as if they were traps—and, of course, many were. While Parker succeeded in making him seem evasive and oratorical, he perhaps succeeded in making Parker seem literal and even petty. The two did not conceal their hostility and contempt for each other. When Parker was attempting to make Selden list specifically the alleged new elements in his engine, the wily patent-holder took refuge in a long discussion of how he had reduced weight, and Parker snapped:

"Answer objected to as not responsive. Mr. Selden, I will cross-examine you all summer if you don't answer that question."[64]

He frequently taunted Selden with his evasiveness. Selden on the other hand accused Parker of asking needless questions, of repeating questions, of stretching out the trial process so that Ford could sell more automobiles, and of misrepresenting or trying to qualify his answers.

"You have tried several times to dictate my answer to me," he declared on one occasion, "and so far as I know, you have not yet succeeded, and I really doubt whether you will."[65] On another occasion: "That is another of your gross misrepresentations."[66]

He himself was not above a little misrepresentation. He remarked that Parker had been "choked off from prolonging the examination of Mr. Bentley by an order of the Court." Parker demanded: "Who told

you that I was choked off from examining Bentley by an order of the Court?"

"I cannot say now who it was," evaded Selden; "possibly some one then connected with the Association, or possibly some of my Counsel."

"Whoever originated that statement is a liar," said Parker.[67]

Parker had sharp encounters with other evasive witnesses for the complainants. Questioning Hugh C. Gibson, an engineer employed by the A. L. A. M., about flame ignition, he provoked the following exchange:

A. I have no knowledge in my present capacity of flame ignition.
Q. What do you mean by "in my present capacity?"
A. I mean that as an ordinary individual without special knowledge I have no knowledge of pure flame ignition.
Q. Have you any knowledge of "purely flame ignition" as used in this case as an expert?
A. I cannot say what I know as an expert.
Q. As a matter of fact, do you know what flame ignition is as applied to that engine [a reconstruction of Selden's]?
A. As an ordinary individual I do not, nor could I possibly.
Q. Do you know as an expert?
A. I cannot tell what I know as an expert.
Q. You mean you can't or won't?
A. I mean I can't as I say.
Q. Why can't you?
A. I don't know.[68]

In other matters, Parker carried complaints of Gibson's refusal to answer questions to the Judge, E. H. Lacombe, who finally instructed the witness to answer. In general, the Selden-E. V. C. witnesses and counsel were obstructive and "non-responsive" on many points. They preferred to keep the evidence as general as possible, a condition likely to favor Selden's large claims; Parker naturally wanted it specific.

As the trial advanced, the "Selden buggy" created an increasing interest among not only the parties to the suit, but the public, which learned about it. Meanwhile, the defense had provided an exhibit almost if not quite as sensational.

It will be remembered that Clerk had asserted that no non-compression hydrocarbon engine (Lenoir's being in question) could propel a road carriage. Selden had previously made the same assertion. It will

also be recalled that Clerk had conceded (and Bentley joined him in this) that if the Lenoir motor were an effective plant for an automobile, Selden's claim to the broad interpretaton of his patent might deserve reconsideration. In its order of March 30, 1907, the Court permitted the defendants to rebut Clerk's and Selden's declarations, and attempt to prove the effectiveness of a non-compression engine. Actually, work had been commenced upon such an exhibit before the order was issued.[69]

The engine was constructed with some advice from Professor Carpenter, and was like a Lenoir, except that it was single- instead of double-acting, and in general resembled the machine patented by Alexander H. Brandon in England in 1869. Fred Allison of the Ford Motor Company seems to have had charge of the engine and of adapting it to a car, with Gus Degener and C. J. Smith assisting him.[70] A Festugière carburetor based on a tracing Carpenter made from the 1865 French patent was an adjunct to the motor. The water-cooling system for the engine was modelled on that of the Rosenwald patent of 1877.[71] Since the sole object of the defense was to demonstrate the capacity of a non-compression motor to propel a car, a 1903 Ford chassis and body were used, with clutch, transmission, and other parts. "I understand that the builders used as far as possible such material, patterns and shapes as they happened to have on hand," Carpenter testified. "As a result the appearance . . . is not essentially different from the single seated motor car in extensive use three or four years ago."[72]

The main exhibits for the opposing sides, the Selden Buggy and the "Ford-Lenoir Car," were available for demonstrations in the summer of 1907. The two models of the buggy were first shown. After a rather perfunctory appearance in a New York garage, where they lacked room to maneuver or to make extended runs, both were produced for official tests at the race track near Guttenberg, New Jersey, on June 14, 1907. Here they were kept in a shed or stable on a raised platform which would give them the advantage of a descent as they issued from the building. The Hartford model of the Selden buggy, Exhibit 157, was the first to be tested. A two-horse truck brought a three-cylinder air compressor with a tank to the stable, a line was run in, and air was pumped into the reservoir of the car. Gibson, the engineer in charge, tested the ignition device, which was electric, although Selden's original application and his patent had specified flame ignition. Then

the engine was started and the buggy moved forward—about five yards. To quote Duryea, it "had only proceeded eight or ten feet when the engine stopped. The vehicle coasted about six feet further by which time the front was outside the stable door where it stopped with the rear wheel inside the slight threshold."

Carpenter compiled a time schedule which records the precise sequence of events that afternoon:

2:43. Car started from its position in shed. Ignition stops, but car coasts about ten feet outside of shed door and stops at foot of slight grade.
2:45. I noted that the air pressure on compressor was 120 lbs. I was informed by Mr. Henry Selden [one of George B. Selden's sons—George B. Jr. was the other] that a pressure of 150 lbs. was ordinarily used.
2:46. The fuel tank was charged. . . .
2:48. Engine started with air pressure supplied by internal compressor.
2:48.5. Clutch applied; one wheel turned a few times without moving car.
2.50.5. Old sacks applied to ground under wheel evidently to prevent slipping.
2:51. Engine stopped, Mr. Parker suggested that chains be applied to the driving wheel.
2:55. Engine started, clutch applied, and with the help of four strong men pushing the car ascended the slight grade in front of the shed. The engine stopped at a distance of about 100 feet from the point of starting with the car at the top of the grade; it could not be started without moving up the external air compresser by horses and did not reach the race track.

The other Selden model, Exhibit 89, was brought out but also failed to run properly and was pushed back into its shed. Those in charge of the machines then announced that because of weather conditions the tests would be postponed until the following day.[73] On June 15 Exhibit 157 was started, driven on newly-laid planks to the track, and with many stops run more than a mile, returning on its own power to the shed. The longest distance travelled at any time by either model seems to have been 3450 feet, with two stops en route.[74]

Parker was not satisfied with the tests, nor with the machines. He was much annoyed because one Selden buggy had a "77" painted on its side, which he felt created the false impression that it was built in 1877, while the truth was that only a few parts of the engine had been

made prior to 1904.[75] He charged that a considerable part of the construction was attributable to improvements in devices and processes which were not available or effective in 1879, and that the cars were therefore not precise copies of what Selden originally specified.[76] As to the tests, which were designed to show operability, he demanded that certain reasonable stipulations should be met.* Taking pencil and paper, he put his requests in writing on the spot. The final letter of several which he wrote ran as follows:

June 15, 1907.

Samuel R. Betts, Esq.,
William A. Redding, Esq.
Dear Sirs:—I request you

1st.— To start the Hartford-Selden vehicle without the aid of the air-compressor on the truck which is drawn by two horses.
2d. — To back it out of the shed where it stands now. (3:05 P.M.)
3d. — To run it up a grade of five per cent. for, say, 200 feet.
4th.— To run on high speed.
5th.— To change speeds without stopping.
6th.— To run 200 feet and stop two mins.
7th.— To run one-eighth of a mile and stop two mins.
8th.— To run balance of mile, making at least four additional stops. *All starting to be without aid of the air-compressor.*
9th.— To back 200 ft. and stop, then backing again and stop, and then go ahead. All stops to be stops of engine as well as of vehicle. Prof. Carpenter to be allowed to ride with the operator.

At the commencement of the above I desire starting to be made by one man without any assistance.

(Sgd.) R. A. Parker

Betts and Redding refused to meet these simple requirements, argu-

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* Wrote Parker in his brief for the Circuit Court: "Attempts were made by Complainants [illegible] with some minor changes, and *with the radical and entire changes of* [illegible] *system* [illegible] *air tank* [illegible] ere made in the *cooling system;* the crank case cooling system was abandoned, and *entirely new set of cylinder heads* were made with *radical differences* in the *sizes* of the *mixing chambers,* the *sizes of the valves,* the *valve openings,* the *arrangement of the valves, in the fuel system arrangement,* and in the *delivery of fuel by the oil pumps.* The *common* single air tank was discarded and a *separate air tank was furnished for each power cylinder,* making practically *three air tanks and separate engines* working upon only the one common feature of a common crank shaft. The [illegible]

ing that they were "unreasonable" and not demanded by the terms of the court order. Parker persisted. "Will you comply with any of the requests?" he asked repeatedly. Each time he was referred to the original answer.[77] In an interview with a New York reporter soon afterward, Parker stated: "I never contended that a car made in accordance with the Selden patent would not operate mechanically. I contended and contend still, and shall prove, that they are not practical road carriages."[78]

However, he was frustrated by Selden and his associates. They would not admit specific incapacities in the buggy, declaring simply that it had run, and that nothing else was required. Beyond question, the vehicle abounded in defects. It could operate only after careful nursing by engineers familiar with it; its motor overheated quickly; it was not maneuverable in any practical way; it could negotiate only the slightest grades; and it was not built to the precise specifications of the patent. To be sure, it did meet most of the fundamental specifications, and the fact that it ran at times for considerable distances seems to indicate that had Selden in 1879 commanded adequate funds for experimenting, he could have produced a better car. But he could certainly never have made one for commercial use unless he installed a different motor and effected other basic changes.

The car which the Ford Motor Company built [illegible] a demonstration of achievement in the prior art, containing a non-compression motor of the Lenoir type, was ready for exhibition not long after the disappointing and controversial trial of the Selden buggy. Duryea testified that late in July he rode in it through New York City streets; and Carpenter, who also saw and had ridden in it in Detroit, must have examined it even earlier. The essential part of the Ford-Lenoir car, as we have noted, was the motor. This engine and its accessories were of the 1860's; the car was simply a modern vehicle in which these had been installed. Consequently the defendants had a certain advantage; if their motor ran well, no discussion need be given the vehicle. And the engine did run very well indeed. Charles Duryea gave a very flattering description of how the machine was operated on July 29, 1907:

> When I first saw it it was on the second floor at the Ford garage [Broadway near 54th St., New York], and the operator very kindly started it for me by giving the starting crank about one turn, much as a modern auto would be started. He then stopped it by shutting off the spark, and soon

> after by connecting the electric current started it by the use of the spark and not using the crank, as modern four-cycle autos frequently are started. I have seen it started on the spark quite a number of times since. The operator drove the vehicle on to the elevator and it was lowered to the first floor, where it was backed out into the street, being handled by its own power, and then we drove up Broadway, into the Park, around a number of curves and up and down some grades at a speed that I should think fully averaged ten miles per hour, sometimes going faster, sometimes, of course, slower. Coming back, at the Circle [Columbus Circle], at Broadway and 59th Street we were halted by a policeman and turned to the right around the Circle, on the west side of which we were held up by a jam of other vehicles and street cars, the engine running, but the vehicle standing still with clutch disconnected. In attempting to get out of the jam, as soon as the way opened, the operator set the clutch too quickly and choked the engine, as operators of modern vehicles sometimes do, but it was only the work of a couple of seconds to jump out and apply the starting crank and give it half a turn to start the engine again, after which we started up nicely. We then returned to the garage, almost stopping at the gutter, then driving up onto the sidewalk and entrance, after which it was manipulated further for the benefit of others wishing to see it.[79]

Experts and counsel for the complainants examined the machine and some of them rode in it. There was no doubt whatever as to the success of the non-compression motor and its carburetor and ignition and cooling systems, all built to specifications of the 1860's or 1870's. The cylinder dimensions were rather large—bore, 6–1/16 inches; stroke, 7 inches to 7–1/32. The car could run for an hour at a time. It carried fuel, Carpenter estimated, for an hour and a quarter, but the water lasted for only about an hour. On one test it made a continuous run of 8–1/10 miles.[80] Carpenter estimated that it developed about three horsepower. Later Redding asserted that it had only 1.3 horsepower, and argued that it showed that compression motors were superior to non-compression.[81] However, the engine developed enough power to propel a vehicle, which was the question at issue. Undoubtedly it could have propelled one in the 1860's, though less easily. The devices for steering, transmission, and so on were all known then, and could have been utilized, but would not have been so well developed or arranged.

The Selden buggies and Ford-Lenoir car were seen by reporters, photographed, and described. Praised and belittled by counsel accord-

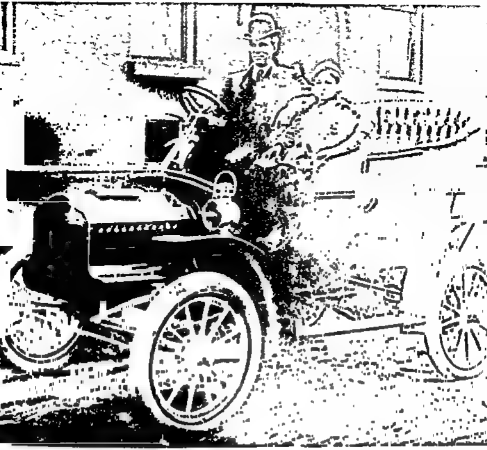
manager for the Association. It numbered forty-eight companies in 1908, and carried on vigorous committee and public relations activities; Henry Ford served on the Standardization and Technical Committee the next year. Among new members were the Aerocar, the Mack Brothers, the Mora, the Reo, and the Simplex firms.[89]

Aside from their general opposition to the A. L. A. M., the founders of the American Motor Car Manufacturers' Association had been prompted by two strong considerations: the need for an organization under whose auspices they could hold their annual showing of cars, and the importance of creating a united front to meet the united assault of the Selden patent-holders.

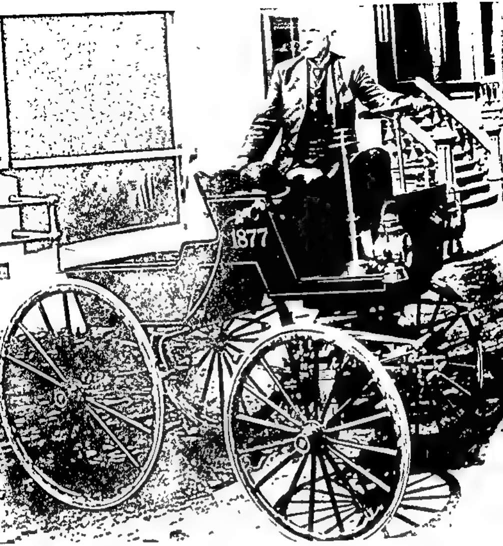
By an aggressive move early in 1905, the A. L. A. M. secured a firm control of the lease of Madison Square Garden, which housed the annual Automobile Show, and announced that it would exclude independents. When the Detroit *Free Press* announced this action on January 25, it reported that "several" independents "intimated that there might be important developments on the other side of the fence." The A. M. C. M. A. was established less than a month later. It promptly rented the 69th Regiment Armory at Lexington Avenue and Twenty-fifth Street, not far from the Garden, then really on Madison Square, for its own New York exhibition. After 1907 the two factions, though sometimes exhibiting together outside of New York, always held separate shows in the metropolis, reflecting their hostility.

As for Seldenite threats, A. L. A. M. officials were active in making them from the time of the first Ford suit, and in the summer or early fall of 1905 sent out notices to owners of imported machines, collecting five per cent on the purchase price from a number of individuals.[90] No suits were brought against manufacturers until the spring of 1907, when nine were filed. The firms selected were the Maxwell-Briscoe, Mitchell, Aerocar, Rambler, Rainier, Marmon, Stoddard-Dayton, and National—all but one members of the independent association. Soon the DeLuxe, Wayne, Glide, Dragon, and Welch were also attacked. Parker acted as attorney for many of the companies.[91] Altogether, according to *Horseless Age*, seventy suits were brought, but could not be carried to a conclusion because of the Ford and Panhard cases.[92]

Thus the A. L. A. M. was unmasking its batteries in sinister fashion, reminding the independents that none could hope to escape. Naturally all looked to the battle in the courts, where Ford was their champion.

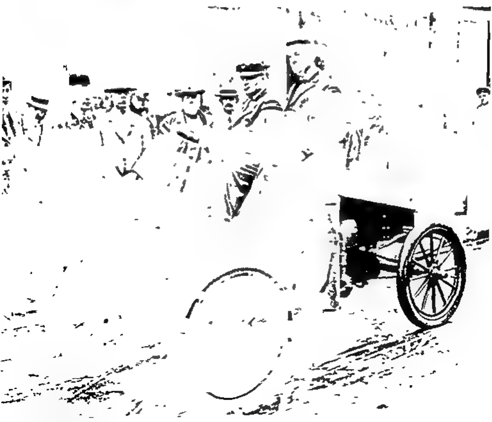


Henry and Edsel Ford in the Model F in front of 332 Hendrie Avenue, then the Ford residence, 1905

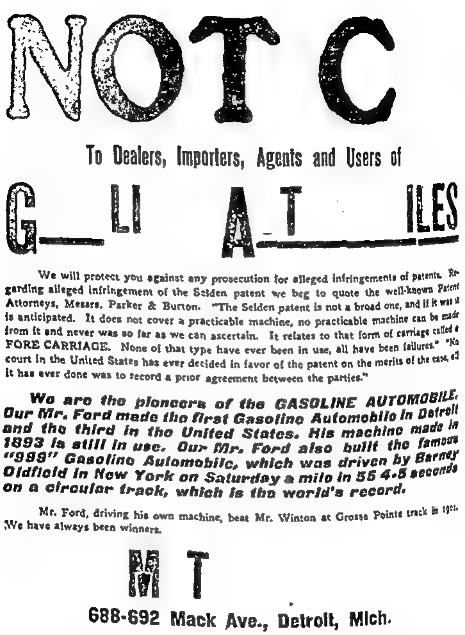


The "Selden Buggy," with George B. Selden in the seat

Ralzemond A Parker



The Ford-Lenoir car, ready for a run in New York



NOT C

To Dealers, Importers, Agents and Users of

G LI A T ILES

We will protect you against any prosecution for alleged infringements of patents. Regarding alleged infringement of the Selden patent we beg to quote the well-known Patent Attorneys, Messrs. Parker & Burton. "The Selden patent is not a broad one, and if it was it is anticipated. It does not cover a practicable machine, no practicable machine can be made from it and never was so far as we can ascertain. It relates to that form of carriage called a FORE CARRIAGE. None of that type have ever been in use, all have been failures." "No court in the United States has ever decided in favor of the patent on the merits of the case, all it has ever done was to record a prior agreement between the parties."

We are the pioneers of the GASOLINE AUTOMOBILE. Our Mr. Ford made the first Gasoline Automobile in Detroit and the third in the United States. His machine made in 1893 is still in use. Our Mr. Ford also built the famous "999" Gasoline Automobile, which was driven by Barney Oldfield in New York on Saturday a mile in 55 4-5 seconds on a circular track, which is the world's record.

Mr. Ford, driving his own machine, beat Mr. Winton at Grosse Pointe track in 1901. We have always been winners.

M T

688-692 Mack Ave., Detroit, Mich.

Advertisement of the Ford Motor Company in the Detroit *Free Press*, July 28, 1903, in response to one by the Association of Licensed Automobile Manufacturers

If he won, every suit of the seventy would be as harmless as a piece of fireworks; if he lost, each would become a death-dealing gun.

Selden and his associates did not neglect publicity and advertising. The patent-holder had now acquired the license of the Buffalo Gasoline Motor Company, which after making its court settlement in 1901 had become an A. L. A. M. member. Selden was manufacturing and selling a car, and paying his royalty—though as Parker took care to point out, it in no way resembled his Exhibit 89 or 157. Selden advertised, the A. L. A. M. advertised, and an Association meeting in New York early in December, 1906, appointed a committee to guide individual advertising.[93]

The Association was weakened in November, 1907, by the death of George H. Day. In the same year it was embarrassed when the Pope Manufacturing Company and Electric Vehicle Company failed, the former in August and the latter in December. Both overcapitalized, they had suffered severely from the rapid decline in the popularity of electrics and the shock of the 1907 panic. The E. V. C. had liabilities of $3,604,141.82, and of its nominal assets of $14,084,432, more than $11,447,000 was represented by patents and patent licenses.[94] Parker at once moved to convert the E. V. C. bankruptcy into a Ford asset. He filed an application in the Circuit Court for the Southern District of New York, demanding that the Company put up security for the payment of costs in the event it should lose the suits, and that if proper security were not provided, the suits should be dismissed. This was a reasonable application, though somewhat indignantly reported by *Motor World*.[95] Eventually the status of the E. V. C. was settled when the Columbia Motor Car Company, incorporated in June, 1909, took over its affairs, and was accepted as a complainant in its stead.[96] A readjustment of royalty for A. L. A. M. members had previously been effected; after June, 1908, the fee was ⅘ of one per cent of the sale price, instead of 1¼ per cent.

Couzens and Ford must have watched grimly the filing of suits by the Selden group, and their publicity and advertising. Their own advertisements and publicity fully matched their opponents. "We will protect you against the 'Trust,'" they declared, adding, "The Ford saves you $600!" The Ford Motor Company was ready to furnish signed articles presenting its side of the case, like that in the Detroit *News-Tribune* of February 17, 1907. "We possess just enough of the

instinct of American freedom," it declared, "to cause us to rebel against oppression or unfair competition." It promised to show "that Selden did not and could not invent any part of an automobile," and accused the Rochester lawyer of being "willing to prostitute his profession and avail himself of the blind alleys of the law to gain an end." Other statements called the claims of A. L. A. M. "a farce," and cited the huge expenses of the litigation as evidence of anti-social behavior.[97]

This stern struggle was brightened by a few acts of courtesy and friendliness. Ford referred flatteringly to George H. Day, "a gentleman for whom personally I have the greatest respect."[98] Selden not only sent Ford a pin, but spoke well of him.[99] In August, 1906, Day and Charles Clifton, then president of A. L. A. M., were in the lobby of a Detroit hotel when Ford and Couzens entered. All four were startled. Then Ford put out a hand, and the enemies chatted until he asked: "How'd you like to look over our plant?" "We'd be delighted," responded Day and Clifton, and the four, entering a Ford, whirled away to the factory.[100]

But the contest remained grim, in and out of court. Millions of dollars and the right to produce freely were at stake. As the case closed and the opposing attorneys prepared their briefs, suspense gripped the automobile world, for all the words and moves of the bitter struggle were soon to end, and from the lips of a single judge would come a verdict as fateful as the voice of Delphi to waiting petitioners.

XIV

FORERUNNER: MODEL N

When the quarrel over car models, which we described before taking up the Selden Case, shook the youthful Ford Company, the automobile industry was still in its experimental stage. Indeed, despite its steady growth it would not begin to reach real maturity until after 1910. The mortality among manufacturers continued high; the *Motor World* pointed out that of the firms which exhibited their product at the two New York Automobile Shows of 1906, one-fifth were missing from the same events a year later. They had found the competition too harsh, the public too quick to reject jerrybuilt machines, the courts too alert to appoint receivers when creditors filed complaints. The industry, predicted the editor, would soon cease to be a reckless game. "It will become a business in which the fittest will survive, and they who will survive are those who are well entrenched and with flags flying that bespeak proud reputations. . . ."[1] Already it was clear that steam and electric models had little future. The *Motor World* inveighed against the hasty, slipshod assembling practised in many factories, with the consequence that a car emerged which was one mass of faults: slack bearings, badly aligned bolt holes, loose nuts, pipes crookedly fitted, and parts poorly machined.[2] Slowly, unevenly, but inexorably, a score of strong companies were pulling to the front, leaving several hundred others struggling in the ruck. Among these stronger companies, but by no means foremost, was the Ford.

Year by year, although experimenting sometimes took fantastic directions, better models were made and more efficient factory methods were introduced. The Ford organization was about to take a long stride forward in both respects. The new four-cylinder Model N was much better designed than its predecessors—was in fact one of the best-designed cars yet seen in the United States; and the two plants were

destined to develop much better production techniques. The Ford Manufacturing Company, besides serving the double purpose of getting rid of Malcomson and enabling Ford to make his own engines and transmissions for his inexpensive car, accomplished a still larger object. The division of work between the Bellevue and Piquette factories, followed by reorganization and enlargement of the Piquette factories, made it possible for such plant captains as Max Wollering and Walter E. Flanders, C. Harold Wills, and the other talented associates of Ford, to take the first steps, 1906–08, toward a production system that within the next decade became not only world famous, but a world force.

2.

A burst of enthusiasm greeted the Model N. "This car," declared the *Cycle and Automobile Trade Journal,* "is distinctly the most important mechanical traction event of 1906."[3] No sooner was a specimen car exhibited at the annual shows early that year than orders and checks rained upon the company. During May, Couzens had to return about $1000 daily to buyers who demanded impossibly early deliveries; and one order for 300 cars was accompanied by a draft for $30,000. A four-cylinder runabout for $500!—it seemed too good to believe. Early in the year, Ford and Wills had completed the detailed blueprints and patterns for the car, which they had conceived as "all automobile"—that is, all efficiency, with no frills. On Saturday, June 2, Ford took a writer on a fifty-mile trip to Pontiac and return, climbing the longest and stiffest hill on the route in high gear without touching spark or throttle. "I have never made that hill so easily with any car whatever," said Ford.[4]

The company's plan was during the next spring to install improved machine tools and other equipment in the factories, and beginning July 15, 1906, to make daily deliveries of 100 cars. When Wollering arrived that April, the Bellevue plant was being prepared for the rapid fabrication of engines, axles, and gears. Wollering was a skilful manager in installing jigs and fixtures, which he called "farmer tools," saying: "Bring in the farmer and put him on the machine, and he can do just as good a job as a first-class mechanic."[5] But the company met unexpected delays. The automotive industry was expanding like a balloon over a gas main; the demand for machine tools and

automobile parts by competing companies was insatiable; and bottlenecks developed in half a dozen supply lines. It was autumn before the Bellevue shops were making a hundred engines daily and the Piquette assembly rooms were in full clatter. For Henry Ford realized that complete advance work—the full establishment of the new equipment and routines—was essential to the production of 10,000 to 15,000 Model N's a year, at which he aimed; that only precise machining of standardized parts in huge quantities would permit rapid assembly, heavy sales, and low prices.

"The manufacturing world stood aghast," said one automobile journal three years later. "Only a very few believed that the company would progress far with so radical a departure." But Couzens and Ford never lost confidence, and the fall at last brought complete success. Even yet, because the plants were in rapid evolution, manufacturing procedures were rather hurried and crude. Max Wollering in his reminiscences in the Ford Archives makes this clear. He writes that the Model N engine blocks were cast at the Detroit Foundry and sent to the Bellevue plant by horse wagons:

> First of all we put the engine block into a filing jig, as we called it, because there were certain locations of the cylinder that had to be squared up. Then of course it went to the milling machine. It was a two-cylinder affair. There were two castings on the four-cylinder motor. Each casting contained two cylinders. Then it was milled on the bottom and set up, and we drilled the holes for bolting it to the crank-case. . . . The second operation was the boring. Then the valve seats were bored and fitted.
>
> We had special milling machines and special boring and drilling machines. The drilling machines were multiple drills for the eight holes.

Only one engine-block at a time was sent through these processes, and it was handled in what would soon have seemed a primitive manner:

> The block was passed by hand from one station to another. We put up short conveyors to push it along to the next operation. It was not automatic. It had to be hand conveyed. When the man finished the milling operation he'd take the block, put it on the slide, and push it over to the next station. They would pick it up and put it on the drills and then they'd push it on. There wasn't any hand carrying in the plant from one station to another. It went along pretty much on slides until it was finished; then, of course, it was trucked to the assembly room.

Already, however, the rudiments of progressive machining operations for the engines were coming into existence:

> We didn't group our machines by type at all. They were pretty much grouped to accommodate the article they were working on. They were beginning to set up progressive flow. I think I worked out that layout myself. I did quite a lot of rearranging myself. When I got there, they had the milling machine, which was very big, and the boring machine, which is large, in place. I left them stand and we built around them. We put the others in to make a kind of progressive arrangement.

From the machine shop the motor went to the assembly room, where cylinders were fitted on the crank-case, the crank-shaft was inserted, and the pistons and connecting-rod were attached. To execute these successive steps the motor was placed on a rack, which could be revolved to turn it upside down when necessary. At first, in the summer of 1906, three racks were used and three engines assembled at once; later, when seventy-five motors a day had to be finished at the Bellevue plant, five or six racks were employed. The engine parts (that is, cylinders, crankshafts, pistons, bearings, push-rods, and so on) were trucked into the assembly room in specially built boxes.

When the engine was fully assembled it was lifted to a hand-truck, the flywheel was bolted into place, and it was sent to the test house. Here the ignition system was connected with a battery, fuel was supplied, and the engine, if not defective, whirred into life. Testing, however, was also still in a rudimentary stage. The plant had no dynamometer, and at the test house the engines exhausted into the building itself, instead of onto the street. "It was a crude affair," ruminated Wollering long afterward, "but it did the job." Once tested, the engines and gears were hauled in horse-trucks to the Piquette assembly plant.

The first engines for the Model N's, though in general excellent, were defective in various particulars. The engine block was cast in two units of two cylinders each, a method upon which Ford was soon to improve. The cam-shafts were flimsy and frequently broke; efforts had to be made to harden the steel, and they were not fully successful until 1907. Then the machining of the cam-shafts, a specially delicate operation, proved difficult to adjust so that the working of all pistons and valves was perfectly synchronized. Wollering remarks with feel-

ing: "That was the biggest bugaboo, to get our timing right, and have one cam-shaft fit another motor; [so that we could] take one out of this motor, and put it in that one, and it would be right." The magneto also gave endless trouble, Ford, Wills, and "Spider" Huff spending long weeks trying to make it trustworthy. In meeting the various problems, says Sorensen, Ford exhibited great ingenuity; and taken as a whole, the Model N was for the time an admirable car.[6]

Here was a compact four-cylindered, fifteen-horsepower vehicle weighing only 1050 pounds which could make forty-five miles an hour, could cover (so Ford declared) two hundred miles on ten gallons of gasoline, and was expected to sell for $500. The Cadillac runabout had only two cylinders; most of the "gasoline buggies" which had a sudden vogue in 1907–08 for rural use had only one cylinder. If still reminiscent of the buggy in the lines of its two-passenger seat and folding top, the Model N was nevertheless trim and dashing; the engine was placed in front under a nickeled hood, two handsome nickeled lamps adorned the radiator and two more the dash, the wheels were cupped under short mudguards, and the short fenders were brightly polished. It compared favorably in appearance with the smarter models of the day, while considering all its equipment, the car offered remarkable value for the price asked. Orders were stimulated by Couzens's advertising and by Ford's brisk assurances that he had long intended to make "a car for the ordinary man" of the best materials, "absolutely guaranteed in every respect."

Ford divided his time between the Motor Company factory on Piquette and the Manufacturing Company plant on Bellevue Avenue, often bringing Edsel (thirteen in 1906) along to both places. He insisted on constant progress in the precision machining of standardized parts, so that any element in a Ford car could be fitted into another car without undue readjustment; and of course the fixtures, drills, jigs, and milling machines were designed to make this possible. Harold Wills, as chief engineer (though, we repeat, Ford disliked and avoided formal designations of rank), also divided his time between the two plants, and during the spring of 1906 used to help Wollering start the large gas stationary engine at the Piquette Avenue establishment at six-thirty in the morning; later, they had a mechanic do this. One observer, the same man who found a "mean streak" in both Wills and Ford, thought that these two men watched each other a bit suspiciously.[7]

It is not unlikely that Ford had some fear that Wills might try to launch an automobile company of his own, as eventually he did, and that Wills had some apprehension that Ford might tyrannize over him. However this may be, Ford was quietly but emphatically the head of the plants and made his fundamental ideas plain without undue emphasis.

He was fairly strict about cleanliness and orderliness, and still stricter about accuracy. He disliked the payment of men by piece-work, then widespread in the automobile industry—the Dodge plant, for example, remained a piece-work plant. Ford thought that this system resulted in hurried and defective production, and preferred fixing a reasonable standard of output, paying a fair wage, and hiring men who could maintain the standard. When mechanics were recompensed on a piece-work basis, he insisted on rigid inspection. He liked to train men for work, and if he could not find an expert mechanic, would unhesitatingly hire a laborer from the street and school him for the task. At this period he spent a good deal of time simply walking about the various departments, scrutinizing the operations, seldom giving orders and never scolding, and often chatting with the men he knew best.[1]

In these chats he liked to talk about making huge quantities of low-priced cars. "Mr. Ford," testifies Wollering, "was a great man for believing that he must supply the masses, and of course that meant a cheap car and a good car. His theory really was, 'Max, we'll build more of them and cheaper; better and cheaper.' That he sprung at us all the time." In the experimental room, where of course he spent most of his day, he was sensitive to the morale of his helpers. For a time, in developing the first Model N, the force worked on a three-cylinder engine; it was unsuccessful. They also tried a five-cylinder engine!—which was a total failure. Occasionally everything seemed to go wrong; the draftsmen or mechanics made mistakes; men lost their tempers. Fred W. Seeman writes in his reminiscences:

> When this tension was built up, and Mr. Ford would come into the room, this fellow or that fellow wouldn't speak, and he would notice that that happy spirit wasn't there of full cooperation. . . . And then he would go around and kind of talk to this fellow or that fellow, and pretty soon he'd play a trick on somebody or connive with somebody to play a trick on one of them, and after that happened, why, it seemed that the boys all got together in a more cheerful mode of working. He was very observant and if everything wasn't going smoothly, he would notice it immediately.

Several times he asked me, "What's the trouble, Fred?" He'd try to smooth it out.

During these years, his enterprise becoming an assured success and his fortune made, but his burden still easily manageable, Ford was usually jovial and companionable. When in a relaxed mood, states Wollering, "he joked and talked about everything under the sun." Frequently on a Friday afternoon of propitious weather he would come to Wollering and announce: "Max, we'll go out shooting tomorrow afternoon." A little group regularly shot clay pigeons, Ford helping manage the trap and displaying fair markmanship with a shotgun.

As soon as the Ford Manufacturing Company had its factory running smoothly, the worst faults of the Model N engine were rapidly corrected. This new cheap car would clearly be much better than the old Models C and F. The Ford Motor Company prepared to advertise its salient advantages—its strength and lightness; its efficient engineering; and the availability of ample stocks of precision-made parts for repairs. "Beware of 'assembled' cars," ran the advertisements the company was writing for the 1907 season; "not only automobile makers but several parts makers are tottering to a fall today—haven't the knowledge, the experience, or the facilities to compete with well organized plants."[9]

And meanwhile the expulsion of Malcomson was completed; an accomplishment which gave Henry Ford a clear road to absolute control. The very success of the Model N meant the rout of the expansive coal-merchant who had pinned his faith to a costly car.

For this success was immediate and tremendous. When the Model N finally reached full production in the fall of 1906 dealers were enthusiastic, customers crowded forward with orders, and a heavy advance demand for the 1907 output appeared. A golden harvest lay ahead. At a stride Ford was becoming the largest manufacturer of motor cars in the world. The new automobile, which by virtue of its sturdiness and lightness was the direct progenitor of Model T, had an irresistible popular appeal. But meanwhile, sales of the expensive Model K, successor to Model B, were disappointing for 1906. In those months the Ford Motor Company, dependent on it and the last of the Models C and F, was barely holding its head above water. The total sales of cars in the year October 1, 1905–September 30, 1906, came to 1599, or fewer than the previous year. The profits of the Ford Motor Company for the same twelvemonth dropped from $290,194 to $102,397. Only

a single dividend was paid on Ford Motor Company stock in the calendar year 1906, and this was a pitiful $10,000 disbursed on October 24.[10]

In fine, the cheap new car augured a brilliant future for the Ford enterprises—but the profits on it could readily be siphoned off by the Ford Manufacturing Company, leaving little for the Ford Motor Company stockholders. The keen competition among makers of expensive touring cars, and the grumbling of many buyers over upkeep costs, indicated a rapid subsidence of the vogue for such models.

The unhappy Malcomson saw the handwriting on the wall. For a time he had made loud threats of a lawsuit. By May, 1906, however, he had decided to extricate himself from a concern in which he could no longer hope for real profits. The kindly spirited man disliked controversy; the costs of a dragging suit frightened him; and he was intensely interested in the Aerocar Company, in which he was reported to have invested $90,000. Negotiations for the sale of his stock dragged over several months. The discussions were carried on by Couzens in an atmosphere of glacial hostility, the worsted co-founder vigorously expressing his chagrin and resentment. Finally, on July 12, 1906, Ford bought for $175,000 Malcomson's 255 shares, a little more than a quarter interest in the company. Measured by Malcomson's expenditures of money and effort in behalf of the company, this was a large price; measured by the huge profits in the ensuing years, it was pitifully small. Evidently Ford had poured most of his savings into the Manufacturing Company,* for in paying Malcomson, he had to borrow money from William Livingston, head of the Dime Savings Bank, Couzens endorsing his notes.[11] Couzens now succeeded in name, as already he had succeeded in fact, to Malcomson's place as treasurer.

Inevitably, this internal battle had cast a heavy cloud over company affairs. Malcomson, with all his faults of rash adventurousness, had many staunch friends in Detroit, including three Ford stockholders, Fry, Woodall, and Bennett, who stuck by him to the last. Everyone knew that the enterprise could never have been started without his influence and money. It seemed unjust and ironic that just as the company was emerging to full success a violent quarrel should cast him out; but he was largely the author of his own expulsion, for as Bennett admits, he hardly "went up to that factory on Piquette Avenue twice

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* At dates which cannot now be exactly ascertained, the Ford Manufacturing Company borrowed a total of $53,000 from Henry Ford, and $45,000 from the Dodge brothers. The directors ratified these borrowings at their meetings on May 24 and December 12, 1906. Directors' Minutes, Ford Manufacturing Company, Ford Archives.

a year." During the controversy, Couzens and Ford did their best to keep their employees and fellow-stockholders heartened. Couzens saw to it that all the best men in the shop were fully informed of what was going on, and took pains to tell them: "Now stick around, you've got better days coming."[12] Charles H. Bennett, who had brought his earnings from the Daisy air-rifle into the company, tells us that Ford kept exhorting him to hold on to his stock. "Don't sell out. You'll be taken care of; I'll see to that." In general, the morale of both the Ford companies was kept high, particularly after Model N gave such radiant hope for the future.

Nevertheless, the three stockholders who had stuck by Malcomson's side, Woodall, Fry, and Bennett, left the Ford Motor Company during the next year. Woodall was the first to go, selling his ten shares to Ford early in September, 1906. On September 1, 1907, Bennett sold his fifty shares, Couzens taking thirty-five of them and Ford fifteen, while on the same date Ford took all fifty of Fry's shares.[13] Bennett had been so closely allied with Malcomson, according to his subsequent statement, that when the lawsuit was threatened, he had gladly lent his stock to the merchant to strengthen his case.[14] Sometime earlier the carpenter, Albert Strelow, had become infatuated with a gold-mining venture in British Columbia and had incontinently sold his fifty shares to Couzens for $25,000—which the poor fellow completely lost. In this sale he threw in with his stock a block of 31.8 shares in the recently formed Canadian Company, just as good measure. "I handed them to Couzens for nothing," he wailed later. "Now that Canadian stock is worth a fortune!" Before many years Strelow was to be seen at the Ford offices, asking for a humble position.[15]

Death took the first of the original stockholders when on July 6, 1906, the old banker, Gray, succumbed to a sudden illness. At the next meeting of the directors Couzens moved that Ford be chosen president in Gray's stead, and when this motion carried, John F. Dodge was made vice-president. Gray's heir, David, receiving a single share of stock from the estate, was made a director.[16] As a result of the convulsion in company affairs, by the fall of 1907 the roster of stockholders was reduced to eight:

Henry Ford	585 shares	John F. Dodge	50 shares
James Couzens	110 shares	Horace E. Dodge	50 shares
Gray Estate	*104 shares*	J. W. Anderson	50 shares
David Gray	1 share	H. H. Rackham	50 shares

A revolution had taken place. Managerial control had been fused with stock control; the power of Ford and Couzens was now complete, and of these two, Ford as president and as majority stockholder held an absolute supremacy if he chose to exercise it. The company was his in fact as well as name. He could assert his will in its affairs to an extent seldom exemplified in the greater American corporations, far more completely than Rockefeller had ever wished or tried to do in Standard Oil, more completely even than Carnegie had done in his steel company. That this unrestricted power carried insidious perils as well as challenging opportunities, the future—fortunately the distant future—was to make all too plain.

3.

The way was now open, without impediment, to the manufacture of a cheap car in unexampled quantities. To Henry Ford, and in lesser degree to Couzens, this was the fruition of a great dream. On the July afternoon that Ford bought Malcomson's stock, he asked the mechanic, Fred Rockelman, as he often did at nightfall, to take him home. As they drove along in the dusk he grew confidential. "Fred," he said, "this is a great day. We're going to expand this company, and you will see that it will grow by leaps and bounds. The proper system, as I have it in mind, is to get the car to the people." He dilated upon the role that the automobile might play in helping Americans and Canadians and Mexicans, and the diverse peoples of Europe, to know each other better. "If you get people together so that they get acquainted with one another, and get an idea of neighborliness, the car will have a universal effect. We won't have any more strikes or wars." [17]

Ford's decision to stake the company fortunes on the Model N was not merely a decision for the cheap car, but a decision to move toward the manufacture of one chassis and only one. This took courage, but at the time it was sound economics. One factor thrusting numerous early companies into bankruptcy was their production of too many chassis. Just before the First World War one of the largest automobile makers said that no company was strong enough to build two chassis every year without going broke.[18]

Yet some ambitious companies made three new chassis every year. The costs of designs were heavy. Moreover, at the end of three years

they had nine separate chassis on which to furnish spare parts; at the end of five years, fifteen chassis. Now to make parts in quantities of less than fifty was unprofitable. The manufacturer was thus placed in a dilemma. He must store a large quantity of parts which might never be wanted, or he must produce in small quantities at practically machine shop costs, either taking a loss on parts sales or charging so much as to discredit his machines. Ford's principle of one chassis meant the quantity manufacture of spare parts at extremely low cost.

Also, by adopting the single chassis, Ford could escape the curse of the annual model—for most manufacturers in 1906 agreed that it *was* a curse. The routine of production and sales for most companies was then as unfortunate as it could be. The automobile year began about September 1 with the brisk selling of new models. This continued all autumn. Production dropped off at the same time, however, and in most factories by October 1 nearly ceased, for dealers wanted only sufficient cars for fall sales. In midwinter, with the northern roads storm-swept, selling nearly stopped. Early in the year the factory again began working frantically to furnish its dealers a stock of cars ready for delivery in the spring. By April, retail selling was brisk again, and continued so for ninety days. Meanwhile production again slackened, to allow dealers to clear out their old models. By the beginning of July retail sales had nearly ceased. But about this time the factory began work again on new models, straining every nerve to give its dealers a fresh stock by September 1.[19]

All this meant that factory overhead and sales overhead continued for twelve months while operations were concentrated into about six months of intermittent work. It meant that cars had to be manufactured in anticipation of demand, most companies thus needing large banking credits. It meant that labor had to be brutally discharged at one season and then hurriedly hired at another under highly competitive conditions. Except for costly cars which relied on the style factor, the making of new models was so badly overdone that by 1914 much of the industry was revolting against it; Ford simply anticipated a general movement.

Ford intended for the season 1906–07 (fall to spring) to manufacture two models on one chassis: the low-priced Model N, and a cosmetic version of the same car called Model R at a slightly higher price—"a car of more pretentious appearance," as the company an-

"Mr. Ford, that is a magnificent idea. If you are determined to do that, I'm sure that in time you will accomplish it. Of course, as I see it, it will take a lot of hard work, a lot of development work, and of course, a lot of money to go on with it."

He replied immediately, "Charlie, I'm going to do that job, and you're going to be one that's going to help me." And he slapped me on the back with that statement. He left me with a little casual remark: "You go on, Charlie, with what you were going to do. I'm going to see that this job is finally accomplished. I'm determined to do it, and nobody, Couzens or anyone else, is going to stop me on it."[24]

Of course, Couzens's fears of financial embarrassment soon vanished. Cash poured in with the Model N orders. Flanders brought in an expert stockkeeper, who established a continuous inventory of materials and parts, whittling them down to not more than a ten-day margin; thus the parts makers carried most of the inventory costs.

The new program of large-scale planned production was defined by Flanders in a policy memorandum which was approved by Ford about October 15, 1906. No doubt Wollering, Wills, and others assisted Ford and Flanders in hammering it out. It called for the manufacture, in the next three hundred working days, of 11,500 of the cheap cars, along with 600 of the more expensive type, the Model K, and a suitable quantity of spare parts.[25] This would mean a business of about six million dollars gross.

The Ford Manufacturing Company and the Ford Motor Company were now being brought into close alignment preparatory to a complete merger. Since Malcomson was out, the policy of the cheap car triumphant, and Ford the owner of a controlling share in both corporations, no reason for a continuance of the division existed. The policy memorandum looked to an early consolidation. It indicated, however, that Ford and Flanders wished certain reforms carried out first. Some passages suggest, indeed, that Ford had been irritated by Couzens's interferences, and wished to achieve a sharper division between *his own* sector and Couzens's business office. Thus the memorandum stipulated that labor management, materials purchasing, and manufacturing should be under one head, with authority to employ men, buy materials, and deal direct with suppliers of rough or finished parts. It also proposed that the manufacturing department should have at least two weeks' notice of shipments to be made. "If the above arrangement

for purchasing materials and handling same is not agreeable to *all parties interested* in this company, and they determine that part of the purchasing of both N and K cars should be handled as heretofore, the manufacturing department must not be held responsible for output." Repairs and returned parts were to be kept strictly under the purview of the mechanical department. "It has apparently been the custom for *office men* to give orders to destroy material of much value, one instance of recent occurrence [being] where sixteen radiators were broken up with a hammer, most of which could have been repaired. . . ."[26]

4.

It had been Ford's hope that he might price the Model N at $500 retail. Every effort had been made to hold costs down. The Manufacturing Company had at first contracted to supply the Motor Company with ten thousand chassis at a price not to exceed $206 each; but later it had modified this contract, agreeing to supply the complete motor, transmission, frame, and axles, fully tested, at $135.[27] Ford was exultantly declaring to reporters:

> I believe that I have solved the problem of cheap as well as simple automobile construction. Advancement in auto building has passed the experimental stage, and the general public is interested only in the knowledge that a serviceable machine can be constructed at a price within the reach of many. I am convinced that the $500 model is destined to revolutionize automobile construction, and I consider my new model the crowning achievement of my life.[28]

To help keep prices down, the company limited the discounts allowed dealers to ten per cent of list price. Any dealer who agreed to accept a specified number of the Model N in monthly shipments was guaranteed their delivery; an important matter, for they were selling like hot cakes. For every ten of the cheap cars ordered, however, a dealer had to take one of the costly Model K's, this being a six-cylinder car a little better than the old Model B, weighing a ton and priced $2800 at retail. A $200 deposit was required for every Model K ordered.[29]

But it proved impossible, to Ford's great disappointment, to maintain the Model N price at $500. For a few months the runabout was sold at that figure with two-and-a-half-inch tires. Then customers were

told that the company had decided, after due tests, that three-inch tires were the only satisfactory size, and should be bought at $50 extra. Tools were furnished free, but additional charges were made for lamps and horn. By the fall of 1907, when production in volume began, the list price with three-inch tires was standing at $600.[30] Even so, the Model N remained a bargain—perhaps the best car on the American market at the price. Those who wanted the better-looking Model R and S got practically the same car with slight differences—a footboard instead of a small carriage step, a mechanical oiler instead of a force-feed oiler, and (for the Model S) a single-seat tonneau at the rear.[31]

As for the Model K, that, like Malcomson's old favorite, the Model B, simply had to be forced upon the market. The company proclaimed that it would accept no new agents who did not take at least one Model K; it allowed a twenty per cent discount on that model; it tried to insist on the new sales rule of one Model K (with a $200 deposit down) for every ten Model N's. All this was of no avail. The Dodge Brothers made the engines for the K as they had for the Model B, and their contract was not highly lucrative. They agreed near the close of 1906 to manufacture and deliver 650 motor sets for $357,500, or at the rate of $550 a set. These, to be known as the 1907 model, were to be of the same design, construction, and material as 350 sets furnished in 1906. Henry Ford was vested with complete authority "as to the necessity and expediency of making such changes and alterations" as might be needed, while he and John Dodge were to pass on questions of materials and workmanship. The Dodge Brothers of course lost heavily when Ford carried out his resolve to make the engine and other main components of the cheap car in his own factory. They knew, however, that this was an indispensable step if the company was to grow, and as holders of a hundred shares of the Ford Motor Company they shared in the profits.

The sales of Model N for the year October 1, 1906, to September 30, 1907, proved highly gratifying. In the previous year only 1600 cars, as we have seen, were marketed. But now, taking N, R, S, and K together, the total reached 8243 cars for a gross return of $4,701,298.[32] Despite the panic which struck the country late in the year, the demand continued firm. Ford had staked reputation and fortune on this cheap new model. He could well be happy over the outcome—but already he had a new and better model in mind, the Model T.

One sequel of the success of Model N was a general increase in salaries within the Ford Motor Company. Couzens in the fall of 1906 applied to the directors for higher compensation. "I think you are fully conversant with the amount of work and the responsibilities involved in my work," he argued, "and particularly during the past year as well as [at] the present time, also that the compensation is not in accordance with what others in like positions in other companies are receiving." He proposed a salary of $10,000, with a commission on every car sold. The board agreed on condition that Ford give his written approval—which was at once forthcoming. Then in the closing days of 1907, when it was evident that revenues would be great, Couzens's salary was raised to $25,000 a year, and the commission on cars dropped.[33] Here it was destined to remain until early in 1910, when, profits having become dazzling, it was lifted to $75,000 annually.[34] So swiftly had the clerk and car-checker of Malcomson's coal business risen to fortune!

Flanders' salary was increased to $10,000 in November, 1906. As for Ford, his compensation rose at the end of 1907 to $36,000, and early in 1910 to $75,000. In reality, the salaries of Couzens and Ford counted for little compared with the fortunes given them by dividends and by the rise in the value of their stock.

The total net profits for the year ending September 30, 1907, came to slightly more than a million: $1,015,020. For the ensuing year, 1907–08, they were to be somewhat larger: $1,055,000. Thereafter they were to rise in a dizzy crescendo. On November 13, 1907, a dividend of $100,000 was paid. Profits were being conserved, as we shall see, for expansion of the plant along lines plotted by Ford. The head of the company had grandiose plans for the future—plans of which he talked freely, and which gave his friends a sense of vision and foresight. Roy D. Chapin was one who thought his ideas were those of a great business leader. Talking with Chapin and E. R. Thomas of the Thomas Motor Company of Buffalo in 1907, Ford said that he was going to produce a four-cylinder automobile, that once it was produced he was going to stick to that standardized design without changing it, that he was going to reach constantly toward a growing volume because it would drastically cut his costs, and that he was going to reduce prices steadily. "He was the first man I ever heard enunciate that theory in our industry," said Chapin, "and was alone in its practice for a good many years.

His practice had created a precedent which in fact is now being followed in all American businesses." On this all-important basic policy, as Chapin said, the success of the Ford Company was founded.[35]

5.

Just as the formation of the Ford Manufacturing Company had a double object, so did its absorption into the Ford Motor Company early in 1907. By the sale of its assets and good will to the parent corporation, Ford, Couzens and their associates restored the unity of their great enterprise and redeemed the promise made to Gray that as soon as Malcomson was evicted, the divorce would be undone. At the same time, this re-establishment of one great company was a step toward the consummation of Ford's plan for bringing under one roof (where he could supervise every step in manufacture from the arrival of the raw material to the emergence of the finished car) nearly the whole work of car-making. It would have to be a huge new roof. The Bellevue and Piquette plants were about four miles apart, and both, since the rush of orders for Model N, were far too small.

A decision seems to have been made by the early summer of 1906; for on August 16 of that year *Motor Age* in an article entitled "To Make It All Ford" reported that Henry Ford and John F. Dodge had been "scouting through the city," and had located a satisfactory site for a new and much greater factory. Unknown at that time, the spot was soon revealed as a tract in Highland Park, at the extreme northern edge of Detroit. A well-known sports property offered sixty acres of ground for a plant, and a race track for testing purposes. The spring of 1907 found the Ford executives busy with architects on plans for the largest industrial establishment under one roof in Michigan, with various subsidiary buildings. Here they intended to place the Manufacturing Company's machinery, much of which was of the latest design, and to install supplementary new equipment.[36] It was time to take such action. Already in the preceding August, *Motor Age* reported in its article about the site, the Company was five months and 6000 cars behind, and had ceased taking orders for that year.

The two companies were united on terms highly profitable to the stockholders of the Manufacturing Company. Making an inventory as auditors of the Ford Motor Company, the N. A. Hawkins firm fixed the physical properties of the manufacturing concern at almost $157,-

000, valued the unexpired contract at almost $177,000, and put good will at $116,653, this last figure being "conservatively estimated" on the costs of organization and the profit-making capacity. The value of the work in progress was computed at just over $86,000, bringing the grand total to $536,365. Couzens represented the Manufacturing Company in the negotiations, and David Gray was the leading figure in urging quick action. No director or stockholder of the Ford Motor Company objected to the transaction. Of course, it was simply a bargain by which the same stockholders in the two companies transferred money from one pocket to another; with the difference that Ford had a slightly larger proportion of stock in the Manufacturing Company than in the Ford Motor Company, and was to that extent a special beneficiary. Actual transfer of title took place May 1, 1907.

No cash was paid; instead, the treasurer of the Motor Company was authorized to issue notes to the stockholders in the Manufacturing Company, bearing six per cent interest. In the final division, Ford received a note for $261,000, and the other six stockholders notes for $31,500 each, to cover the basic payment of $450,000, with proportional notes for the remaining sums due.[37]

The separate company had lasted only a year and a half, but in that time it had accomplished a great deal; and the memory of its effectiveness in disposing of "outsiders" and "parasites" was to influence Ford's future policies. At the end of its first year it had shown a net profit of sixty per cent on its small capital, and on Ford's motion, seconded by John Dodge, it had declared a forty per cent dividend, to be applied to the payments still due by the stockholders for their shares.[38]* This had been just after the Ford Motor Company had declared its single tiny dividend of $10,000 for 1906—a demonstration of the completeness with which the small-car profits had been diverted to Ford's special enterprise. At the time of the sale, the margin of profit on the engines was $37 each, or $370,000 on a production of ten thousand, a very satisfactory rate of return on a plant investment of less than $160,000.[39] However, it was the skills of Ford, Couzens, Wills, Flanders, and their best associates which really made the manufacturing plant valuable.

* [illegible] capital of $100,- [illegible] were $60,000, [illegible] Manufacturing [illegible] sums

In view of the success of the Model N, it was obviously necessary to systematize and strengthen the marketing system. For the first four years of company history Couzens had looked after advertising, shipping, and (except for Wardle's brief regime), sales, exercising general supervision of all agents and branches. He went to automobile shows to recruit good men as dealers; he made sure that the advertising appropriation, for some time set at $50,000, was effectively used; he conferred with the head of the export department, first Lockwood and then H. B. White; he drew the contracts with all representatives. In such branch managers as the jolly, portly Gaston Plantiff of New York, the suave, persuasive Tom Hay of Chicago, and the breezy R. P. Rice of Seattle, he obtained men of enterprise. Plantiff, indeed, made so striking a success that in 1906 the directors voted him a $2000 bonus, to be followed by others;[40] in 1907 his sales totalled more than a million dollars. Hay achieved a reputation as a trainer of capable subordinates, and a cartoon in the *Ford Times* later showed him sending out three brisk young fellows to take charge of the Omaha, Fargo, and Indianapolis branches.

But the task became too great for Couzens. Since marketing urgently needed an expert to give it all his time, the company in the fall of 1907 appointed Norval A. Hawkins, of the firm of accountants bearing his name, to be commercial manager with full charge of sales. For some time, as auditor and financial adviser, Hawkins had been familiarizing himself with the business. His career demonstrated how a man of character and brains, after a bad slip, could make an enduring success. Thirteen years earlier, when cashier for the Standard Oil in Detroit, he had embezzled about $8000, had been convicted, and had served a short prison term. He spoke with disarming candor of his fall into evil: "I put $3000 in the oil business, and besides, I was always a pretty good liver." A crowd of friends waited at the prison gate and helped him to gain a better standing than ever. He made his firm an efficient agency in counselling large industries on better business methods and labor-saving systems. Just before he joined the Ford Motor Company, the mayor of Detroit appointed him to investigate the department of public works.[41]

As sales manager he showed extraordinary talent. An astute Detroit attorney later termed him "perhaps the greatest salesman that the world ever knew," adding that he was "original in ideas, forcible in present-

ing them, a perfect dynamo for work, and a man who gets the quickest execution of any man I ever knew."[42] This view is corroborated by a close observer inside the company. "God, that man had a wonderful set of brains!" recalled this employee. "When he went there, he revolutionized the old sales division. . . . He just turned things topsy-turvy and everything seemed to thrive. He had something new in salesmanship."[43] It was he who started the *Ford Times,* an illustrated monthly (later bi-monthly) house-organ, on April 15, 1908, and he kept its sixteen to forty pages full of items about car design and production, the work of the branch managers and dealers, the testimonials of buyers, and exhortations to better business methods—along with little sermons on self-confidence, optimism, and enterprise. He encouraged a rivalry among the agencies for setting sales records. Though he was accused at times of being both harsh and underhanded in his relations with dealers, his effectiveness was never questioned.

In these early years the sales manager was necessarily a key figure in factory operations as well as marketing. Until 1913 production schedules depended largely on the estimate of future sales, and Hawkins more than any other man fixed these estimates. No automobile company dared to make a much larger body of cars than it was sure of marketing. If a manufacturer had a thousand cars left over at the end of the season, worth $1000 apiece, he had a million dollars in property frozen—and depreciating. If he had to cut prices to sell this excess, his firm lost in prestige. On the other hand, if he ended the season with a number of unfilled orders, this backlog gave him a sense of security and offered a good advertising point. For five years Hawkins helped call the pace of production.[44]

Because of this fact, and of his study of industrial efficiency, Hawkins was given a fairly free hand in replacing the inevitable confusion in the procedures of the fast-growing Ford Motor Company with some real system. He worked out a better plan of departmentalization first at the Piquette factory and then in the Highland Park establishment. He gave the system of cost accounting new efficiency; insisted on proper allowances for depreciation and reserves;* tried to introduce planned economies; and saw to the rigid auditing of all branch accounts. One of his innovations was an elaborate body of forms for accounts and

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* This he had begun to do, simply as expert adviser, in the spring of 1904; see his financial report to the company May 2, 1904, in the Ford Archives.

reports, adapted to the various departments. Henry Ford, who had a psychology alien to Hawkins's, disliked minute record-keeping; he never believed, for example, in meticulous cost accounting. Nevertheless, Hawkins did an important work in promoting plan and order throughout the whole business area—purchasing, stockpiling, distributing, bookkeeping, and selling.

His chief work, however, lay in marketing. Ford asked him in 1907: "Where do you expect to start selling cars?" Hawkins pointed to a grocery store on the opposite corner, saying, "I think we should start there, and then weave the web around until we reach a point where the freight rates change, which means Chicago, or which means Buffalo."[45] The Detroit office kept absolute control over the prices of cars and parts. Both branch managers and dealers were selected with scrupulous care; the company's "road men" kept constant watch over the dealers' financial position, the character of the buildings they occupied, and their standing in the community, and compared them with dealers serving other companies. All contracts with dealers were executed by the Detroit office—never by branches—and discounts were kept rigidly uniform, whether the dealer sold ten cars or ten thousand a year. For selling purposes, all counties in the United States were ultimately divided into townships and all cities into zones; and as we shall see, the company policy was steadily to reduce the territory served by a given dealer, so as to require more intensive effort. In towns and cities, agents were expected to make a systematic canvass, ringing doorbells and talking with all residents. Hawkins himself often went into the field to study marketing conditions. He later testified:

> Dealers were also required to keep a list of prospects. . . . It was the work of these road men, when they went into a man's place, to ask for that prospect list. I have done this myself many a time. I have said to a dealer, "Let us look at your prospect list," and he would take out a bunch of maybe a hundred cards . . . and I would say to him, "Pick out five real buyers out of that list of a hundred cars," and he would shuffle the cards for some little time, and finally decide he had picked out five. Then I would say, "Let us, you and I, get in a car and see if we can't sell these five cars today or tomorrow and bring in some money for the fall season or the winter season."[46]

One of Hawkins's policies was to strengthen the system of distribution by branches, as distinguished from dealers working on a commis-

sion basis. Time proved that for most companies branch marketing was a poor policy. Since branches directly represented a company's dignity they tended to become ornate establishments, reaching an early climax in the Packard palaces erected in New York and Philadelphia at a reputed cost of $900,000 and $500,000 respectively.[47] Salaried men were less enterprising than agents. Branch managers, moreover, often gave service and repairs too freely, charging them to the company. The Ford Company, however, was at least temporarily in a position to make the branch system operate successfully. Since it soon gained a practical monopoly of its field, the cardinal problem was not one of vying with rivals, but of finding all the possible customers in a stated area. The offices could be kept on a modest side street and furnished in keeping with the democratic character of the car.

Above all, as we have said, Hawkins saw to it that strict oversight, frequent inspection, and by no means least, the threat of narrowing the territory assigned if the selling effort was slack, gave dealers large and small a battle temper.

With Couzens, exacting and irritable, Hawkins had occasional quarrels. But in constructive attention to detail he was a man after Couzens's own efficient heart. He overlooked no means of reducing costs in marketing. Typical of his methods was his swift attention to improvements in the company's freighting system. In early years the Ford cars, like all others, were sent to different parts of the country by the simple expedient of wedging three or four into a freight car. It shortly occurred to the company, as we shall see, that it would pay to establish assembly plants in various parts of the United States and ship the parts to them for final assembly. Hawkins then spent six weeks in loading, unloading, and reloading freight cars to find out just how he could pack the maximum amount of material into an ordinary boxcar.[48]

At about the same time that the company hired Hawkins in 1907, it retained an astute advertising manager, LeRoy Pelletier. A little man with a large head, quick and active, Pelletier possessed a varied experience. According to the *Motor World,* he had gone to the Klondike to hunt gold, and had been advance agent for a circus.[49] "He is fairly charged with nervous energy," declared this magazine; "is a brilliant, plausible rapid-fire conversationalist and a clever writer, and is hospitable, ingratiating, and likable to a degree, and resourceful

far, far beyond the average. Even the great Barnum himself would have found him a valuable assistant." While all dealers were asked to advertise at their own expense, the Detroit office assisted them with copy, mats, and suggestions, and of course, Detroit did the national advertising. Beginning in 1906, branch managers were brought to Detroit at least once yearly, taken over the factory and offices, told by Ford and Couzens of the latest advances, given advice by Hawkins and Pelletier, and treated to a banquet.[50]

Competition being keen, the car had to be pushed in every way; and the Ford Company used newspapers, magazines, billboards, and electric signs in its advertising. It required dealers to put up small signboards, with the Ford signature, on streets leading to their showrooms.[51] No opportunity was missed to obtain free press coverage of the activities of Ford and Couzens. Either the traffic manager at the factory, W. S. Hogue, or Pelletier, originated the phrase "Watch the Fords Go By," which for several years was a favorite slogan.[52] Somebody in 1907 composed a Ford March and a Ford Two-Step which dealers were encouraged to buy for free distribution. The *Ford Times* urged Americans to join in a keep-up-with-the-Joneses movement. "I have noticed," declared the editor in an early issue, "that if Jones buys, Jones has a friend who thinks that if Jones can afford a car, guesses he can, and tells Jones . . . he will buy one too."[53]

Hawkins and Pelletier urged dealers to emphasize the advantages of the light, inexpensive car. Salesmen were instructed to point out that the primary purpose of most cars was to take their owners over country or suburban roads (improving, as we have seen, but still generally bad) in all kinds of weather. Most motor cars cost from seventy-five cents to a dollar a pound; the 1250-pound Model N was naturally much cheaper—forty-eight cents a pound. Place heavy car and light car on a smooth steep hill, and since they had the same power per ton, they would climb it in the same time; but the light car would do it for half the cost in oil and gasoline. Depreciation on the heavy car was more than twice that on the Model N. The tires on the heavy car cost twice as much as those on the Ford, and wore out faster. Every dealer had photographs to show how much better the Ford ran in snow and mud than the lumbering Peerless or Locomobile.

The list of Ford branches steadily lengthened: Peachtree Street in Atlanta, Harney Street in Omaha, Commerce Street in Dallas, all im-

portant cities soon had one. The number of dealers soon rose high into the hundreds. While Couzens was supreme in most business affairs, Ford himself took a keen interest in sales. On July 30, 1907, he sat down in the Manhattan Hotel in New York to write a dealer in Providence, who had complained of reports that he would lose his agency the next season. "I wish to assure you that such reports had no foundation in fact," wrote Ford, "and anyone voicing them did so without authority. I am frank to say we have always considered you the very best agent we have, and I can see no reason why you should not continue to represent us in your territory as long as the Ford Motor Company builds automobiles."[54] It is evident from this letter that Ford held occasional conferences on sales with Couzens and Hawkins.

6.

The fight the company was making against the Selden patent-holders or "automobile trust" gave it much favorable publicity. So also did the interest which Henry Ford still took in racing and endurance contests. He was not always a winner. In the spring of 1905 he told his associates that he wished to enter for the Sir Thomas Dewar trophy, a one-mile straight-away race, hoping to wrest it from a Massachusetts holder. The directors demurred that his life was too valuable to be risked, but finally consented. Although he never competed for the Dewar prize, his new racing car was ready late that summer for an attempt at a new mile record on the beach at Cape May. Under a bright August sun, with ten thousand spectators watching, he covered the mile in the slow time of 51½ seconds. Subsequent efforts brought his time down to 41 seconds, still well above the record mark.[55] At Ormond Beach on January 21, 1906, he boasted that with his entirely rebuilt car he expected to cover a mile in thirty seconds; but it was a Stanley Steamer that made the mile in 28½ seconds—for Ford's fourteen-foot car, with 105 horsepower, went wrong at the start.[56]

Then in 1907 occurred an event which took Ford out of racing for good. At the Michigan State Fair in September he appeared with a new six-cylinder racer which he, Frank Kulick, and another mechanic took turns in driving. Kulick, who had a daredevil temperament, was assigned the task of letting it out to full speed. As he brought the heavy car around the circular track in a cloud of dust, it skidded at the turn, shot through fence posts and heavy wire as if they had been

paper, leaped high in air over the embankment, and turned two complete somersaults. Kulick was hurled from his seat and tossed far from the spinning machine. As man and car crumpled, the onlookers were momentarily frozen with horror. Then Ford and the others tore down the track to the rescue. When one hospital, reached by telephone, refused to send an ambulance outside the city limits, Ford used a crowbar and saw to tear the front seat from a Model K car, had a cot from the ground-keeper's house placed on the floor, and drove Kulick—badly but not fatally injured—to Grace Hospital. This was a telling lesson; Ford never raced again.[57]

From his later racing efforts, if we may believe a passage in his own reminiscences, he had already drawn one unexpected benefit. In 1905, watching a race at Palm Beach, he saw a French automobile wrecked in a smash-up. Already he had noticed that some foreign cars had smaller, stronger parts than American machines. Looking about after the wreck he picked up a valve strip stem, very light and tough. Nobody could tell him what it was made of, and he asked a company mechanic to find out. "That is the kind of material we ought to have in our cars," he remarked.[58] It proved to be a French steel with vanadium alloy. Making inquiries of every steelmaker in the country, Ford found that none could duplicate the metal.

"I sent to England," he wrote later,[59] "for a man who understood how to make the steel *commercially*. The main thing was to get a plant to turn it out. That was another problem. Vanadium requires 3000 degrees Fahrenheit. The ordinary furnace could not go beyond 2700 degrees. I found a small steel company in Canton, Ohio. *I offered to guarantee them against loss if they would run a heat for us.* They agreed. The first heat was a failure. Very little vanadium remained in the steel. I had them try again, and the second time the steel came through. Until then we had been forced to be satisfied with steel running between 60,000 and 70,000 pounds tensile strength. With vanadium, the strength went up to 170,000 pounds." *

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* While we have no reason for rejecting this account by Ford, variant records of the introduction of vanadium exist. Harold Wills told his son that in or about 1905 he attended [illegible] he saw an exhibit of vanadium, and the [illegible] ills, Jr., to the author [illegible] steel in England since [illegible] ientific journals. Large deposits of vanadium were found in South America about the time the Ford Company began using it. Charles Sorensen states that the Ford executives all read about the English advances in metallurgy in technical journals, that he and others knew about vanadium steel by 1905.

In *Harper's Weekly* for March 16, 1907, Ford made his first appearance as author with an article on the uses of vanadium steel. Early that month the company had obtained what it asserted to be the first large lot of the metal made in America. This was a forty-ton heat, made in Canton exclusively for Ford cars—ten times as much as the four-ton heats which the Carnegie Steel Company had turned out at Homestead for armor plate experiments. For several years Couzens and Hawkins tirelessly sang the praises of vanadium. It was epochal, they declared. Ordinary steel had sufficient strength; nickel steel was harder; but only vanadium was able to withstand the strain imposed by bad American roads. "Vanadium steel resists shock—either one blow or a series of lighter ones, or minute vibrations, such as those with which we have to deal continually in the motor car—to a greater extent than any other known metal," declared the company.[60] Vanadium steel indeed withstood fatigue in a way that made it valuable to the industry. And not only was it shock-resistant; it was easier to machine than nickel steel.*

The Englishman who assisted Ford and Wills in obtaining satisfactory vanadium steel, J. Kent-Smith, a consulting metallurgical engineer,[61] seems to have come to the Piquette plant on his own initiative. Manifestly, the company needed a metallurgical laboratory to study alloys and heat-treating processes. Wills remarked that they would employ a university man. "No," said Ford decisively. "Make an expert of Wandersee!" John Wandersee, who had come to the factory as a sweeper, spent three months at the United Alloy Steel Laboratory to obtain a rough idea of the management of a laboratory. By the end of 1907 he was buying the necessary materials and beginning to make analyses.[62]

Ford cars of course continued to play a part, in competition with

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and that when J. Kent-Smith visited the Ford offices about that time, Henry Ford, Wills, and others received him with eager interest, and were quick to respond to his proposals. Sorensen [illegible] the author, June 23, 1953.

* A good deal of the company bragging about vanadium steel was hardly justified It was actually not well adapted to some of the uses given it, and scientific heat-treating of other steels in time gave better results. "For example," states Wandersee, "when we were using chrome vanadium steel for the rear axle of the Model T car, after we had about ten million cars on the road, you could drive from here [Highland Park] downtown any day you wanted to, and see two or three rear wheels lying on the pavement." The remedy was simple: go back to older steels, with scientific heat treatment. "On a lot of parts, like axle shafts, we got much better service and life on the manganese carbon steel properly heat treated than you would get out of a fancy alloy steel." Vanadium steel frequently broke on the crankshaft; the company eventually substituted manganese carbon steel there too with good results.

machines of all types, in races and endurance runs. Though Ford himself took no more risks, he did make another special racer, the 999 II. With this hundred horsepower car Frank Kulick on February 17, 1912, covered a mile in 33⅖ seconds on the ice of Lake St. Clair.[63] More attention was rightly paid to the achievements of the stock cars, and more emphasis was laid on reliability than on speed. The principal keynotes of Ford Company publicity, in fact, were four: the cheapness of the car, both in initial cost and operation; its sturdy durability, to which vanadium steel contributed; its comparative simplicity, which adapted it to mass production by machine methods and made it easier to understand and use; and the cheapness, accuracy, and availability of well-machined parts for repairs and replacements. Advertisements constantly pointed to the ability of the light Fords to climb hills, traverse muddy roads, and buck snowdrifts that turned back heavier, costlier cars. Dealers ceaselessly iterated Ford's idea that while hand work meant at best but a series of mechanical inaccuracies—mechanical fibs—the work of modern American machine tools meant precision—mechanical truth. Two lies always grated; two truths always fitted perfectly.

In Henry Ford's article in *Harper's Weekly* on special automobile steels, quite as much attention was given to machine production as to improved metals. American methods of manufacture, Ford declared, were superior to those of Europe. "European makers are studying American methods and importing American automatic machinery as fast as they can get it—which, by the way, is not very rapidly, for never before was the demand for all kinds of machine tools so greatly in excess of the supply as at the present moment." Once America had automobile materials as good as Europe's (England in particular excelled in alloy steels), the superior American machines and production methods would furnish cars of unsurpassed quality. Ford advertisements in 1907 touched the same chord. "Ford cars are manufactured —have been made in immense quantities and by modern American methods from the first. And the first Ford ever made is still giving excellent service—what of the 'cut and try' contraptions made in that same year?" The combination of cheapness, simplicity, accuracy, and durability, given to the car by careful engineering and mass-production machinery, was presented as the special virtue of the Model N:

> FORD AGENTS RECEIVE LESS DISCOUNT per car than do the sales agents representing any other lines of motor cars. In fact, the difference to the agent as between a Ford $600 runabout and its closest competitor is more than $100. . . .
>
> WE VENTURE THE ASSERTION THAT NOT one agent in ten took on the Ford line willingly—his customers forced it. They asked for Fords. Insisted on seeing them—agent had to get the line in self-defense. Today—you couldn't pry a Ford agent away with a crowbar. He doesn't like the small discount—but he finds the profits on large numbers mounts up in a year. And there's no loss, no dissatisfaction. Next season he will handle no other.
>
> ANY COMPETENT MAN WHO INSPECTS the Ford runabout carefully, critically, must inevitably conclude that, made as it is of Vanadium Chrome Steel throughout, machined with absolute accuracy, perfectly adjusted and tested, there cannot be a very wide margin of profit to the maker —on one car. Since the agent's profit is also small, the buyer must be getting pretty nearly "all automobile" for his $600. That's the point exactly. That's why over 5000 Ford runabouts have already been sold through (originally) unwilling dealers.[64]

That this type of appeal was effective was proved by results. By 1907 automobiles were an everyday sight on most American roads. Five years earlier the proportion of cars to population had been one to every 1,500,000 people; two years earlier one to every 65,000. Now, in the spring of 1907, it was one to every 800 inhabitants. Nevertheless, most cars were not only too expensive for the ordinary citizen to buy (for a price of $1000 up was high when mechanics, clerks, small shopkeepers, school-teachers, and ministers averaged only $600 to $900 a year), but too expensive to maintain. Repair bills bankrupted many automobile owners financially and spiritually. Materials in many cars were bad; roads were murderous; the cost of parts would make a Vanderbilt wince. "Some of our manufacturers," wrote an expert observer in 1907, "charge from four hundred to twelve hundred per cent profit for supplying and attaching a broken part."[65] The Ford Company, like a few others, was trying to make low-cost cars as reliable and as well supplied with good cheap spare parts as a Singer sewing-machine or McCormick reaper.

Couzens directed a special set of advertisements toward physicians, who were told that a Model N would enable them to visit three times as many patients daily as with a buggy. But to everyone, except the

few buyers of the $2800 Model K, economy was made the basis of the sales argument. "Nobody Mortgages His House to Buy a Ford," ran one slogan.

7.

For the automobile industry as a whole the period of experimentation continued; for the Ford Motor Company it was approaching an end. In the four years 1903–1907 the young corporation had fairly found itself. Not without inner friction and turmoil, it had hammered out a successful car, and along with it a manufacturing policy which was as promising as it was bold. It had collected under Ford and Couzens a group of young men as able, energetic, and loyal as any in the entire field; for no one who knew Flanders, Walborn, Martin, Sorensen, Wills, Bornholdt, Emde, Hawkins, and Pelletier could underrate their zeal and talent. It had developed in Ford and Couzens themselves latent qualities of leadership which astonished observers. It had gained national prestige. While declaring ample dividends, it had accumulated large cash reserves in the banks. Its equipment was excellent, and its plans for the new Highland Park plant outran anything yet achieved in the industry. Most important of all, Ford, Wills, and their assistants held already in the eye of imagination a better exemplification of their basic policy, the Model T.

At the Detroit Automobile Show in October, 1907, Couzens and Ford radiated confidence and enterprise. They were not going to rest on their laurels, they told reporters, but were preparing some new departures. One was a taxicab and landaulet, for which large orders had been booked abroad; one was a touring car which they hoped to sell at $800; one was a runabout with rumble seat at about $600—*all on* the Model N chassis. When a writer for the *Motor World* commented that $1000 was too low a price for the landaulet taxicab, Ford snapped: "That's all it's worth." And he proceeded to display a little of what the press was already beginning to call his highly independent philosophy.

"You can never sell many of anything for more than it's worth," he went on. "It's the price we set for it in the first place, and it's the lowest price at which it can be made and sold in the largest quantities. By at once setting the price at that figure, competition is eliminated before it starts. Look here!—look at what we saved yesterday on one

contract alone. On one part the cost of dies was $1400. To build one hundred machines would be $14 each. On the 10,000 we will build it will be 14 cents each. Work the same thing through the whole car and you can get some idea of how we are able to do it." He concluded by speaking of one innovation to come which he hoped would prove "in the nature of forked lightning."[66]

This innovation was the improved model—the car to be called Model T—that was already coming into existence in the enlarged experimental room where Ford, Harold Wills, C. J. Smith, Joseph Galamb,* and others worked so furiously. In the adjoining pattern room the tall blue-eyed Sorensen had gained Ford's approval by making quick *rough model forms to embody the ideas and drawings of the group;* for Ford could correct and improve a rough model more easily than a blueprint. Always restless, Ford was seeking new and larger goals. With a great plant, with a successful policy, with millions of revenue pouring in, he was more self-confident than ever—and he was in a position to dictate. In the revolutionary changes of 1905–07 the company had gained a master with a taste for independence in everything —in designing, in manufacturing, in selling, in financing; a master whose initiative and talents were rich assets, but who might yet prove a despot.

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* Galamb was a particularly important contributor, his value being indicated by the fact that he worked in a separate cubicle adjoining the general experimental room.

XV

NEW GROWTH, NEW PROBLEMS

THE panic of 1907, a fierce summer squall rather than a prolonged storm, gave the whole automobile industry a spell of heavy weather, and capsized many of the smaller craft. Makers of expensive cars and ill-financed marginal plants suffered most. In New York the *World* reported late in August that more than two thousand residents, some of them millionaires, had sold their machines during recent weeks, while almost as many more had cancelled orders for new cars. Since income had dropped, luxuries had to be sacrificed. "The rich man's panic in Wall Street has made all the trouble," said one dealer.[1] Makers of cheap cars were also damaged, but not so severely. Farmers, storekeepers, doctors, and salesmen, who regarded their cars as necessities, continued to buy, though temporarily on a reduced scale. The gross sales of the Ford Company always dropped with the onset of winter. This year they remained above $120,000 even in December, and climbed rapidly as 1908 began. They rose above $150,000 in January, above $175,000 in February, and above $240,000 in March. Then in April and May they soared above all previous records—$595,594 the first month, $868,738 the second.[2]

It had long been recognized that the industry had too many companies, many of them hastily organized, inadequately capitalized, and devoid of engineering skills. Leadership in 1908 had passed to four powerful corporations, "the Big Four," which that year would sell as many automobiles as all other manufacturers combined: the Buick, the Ford, the Reo, and the Maxwell-Briscoe. Of these it was the Buick (now at Flint) and the Ford Companies which had produced the most popular models and found the liveliest sales response. Both made light four-cylinder cars of excellent construction, with strong, durable engines.[3] While these four, and some other large companies with well-

tended reserves, easily weathered the squall, weaker concerns went on their beam ends. Before September 1, 1907, five Detroit corporations had plunged into bankruptcy.[4] They were the Aerocar Company, in which Malcomson had staked his savings and labor, the Detroit Auto Vehicle Company, the Marvel, the Huber, and the St. Clair.*

Naturally, when makers of costly cars, like the Packard and Pierce-Arrow, were hard hit, some observers predicted a strong trend toward *the light, medium-priced machine. "The expensive, heavy, over-rated* motor cars are going out of fashion," proclaimed H. H. Franklin of Syracuse, a veteran of the industry.[5] Actually the big car soon rallied, for it had a distinct place.

The Ford Motor Company possessed large reserves, but it was now operating in the panic period, and its purchase of the Highland Park tract and its absorption of the Ford Manufacturing Company had both entailed expenditures. For the latter transaction it disbursed $536,364, and while this was a bookkeeping operation, it had imposed a strain. The general financial situation of the country was doubtless the most serious factor. Paydays were several times postponed in the fall of 1907 because of the difficulty of getting ready funds. According to George Brown, then an employee, Couzens and Ford resorted to an expedient which was to be remembered by Henry Ford when a period of much greater difficulty overtook the company:†

> . . . In order to get the cash to continue during that little time of depression, Mr. Ford kept building these cars and shipping them out on what they called sight-draft bills of lading, so the dealers had to pay for those cars. They kept sending the cars, and the shipments were pro-rated. Oh, boy, what a squeal! These dealers—what a time they had to get money! They didn't

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* The automobile industry, as was frequently pointed out, was largely an industry of inexperienced men—of amateurs; and it was a very extravagant industry. Many companies borrowed money at high rates. Then they hurriedly erected great factory buildings. They installed expensive machinery. They incurred high overhead charges without adequate knowledge of the future. They bought materials hurriedly; often unsuitable materials, often without dickering over price. They created expensive sales organizations, installing high-salaried men in costly quarters. A manufacturer of a $1000 car who sold about 1500 in a year said in 1912 to Charles Coolidge Parlin: "Our bills for express and telephone more than equal our entire expense for advertising. For example, this morning there came by express a bar of steel, which must have weighed at least 125 pounds." One of the leaders in the industry declared they *had* to be extravagant, for the economics of the industry had as yet not been settled. "That may come, but at present the company that has to stop and figure whether it will pay to send a man to San Francisco cannot succeed." (Parlin and Youker Report, p. 259)

† It should be said that no corroboration can be found for Mr. Brown's story in the company's papers; and although it is probable that the company did bring pressure to bear on dealers to take cars and remit payment, the practise was probably both limited and very brief.

want to lose the dealership, so they did everything, begged, borrowed, stole, to pay for those machines as they were delivered to them.

Couzens did that. In addition to that, instead of paying our bills by cash or by check, Couzens gave them notes. It kept going and going, and it was getting so hot that they designated Mr. Wills to go around to the different manufacturers and explain the situation. As I say, it was only for three or four months, and it soon blew over. There were no payments made and only these notes outstanding, so things opened up and cash started flowing again. The Ford Motor Company was able to pay its bills. . . .[6]

Toughness and resilience were attributes of the automobile industry. The Overland Company, which then made cars in Indianapolis, was just getting fairly under way when the panic made it insolvent; but a former sporting-goods dealer who had gone into automobile-selling, John North Willys, had faith in the Overland car and by heroic efforts obtained enough money to keep it out of bankruptcy. I [illegible] F [illegible] another enthusiast, Charles D. Hastings, threw his energies behind a small car which a Detroit engineer named Robert Hupp had just built, and on $8500 in cash and a sheaf of dealers' orders made the Hupp Motor Car Company an assured success.[7] For the industry as a whole the strain was brief. Early in 1908 the Michigan newspapers were announcing a general upswing in industry, with the motor plants prominent in recovery. The Packard Company, whose normal force was about two thousand, had 1600–1700 men at work in the first week of February. The Cadillac Company by the same date had brought its personnel up to 650, nearly half its regular complement.

As for the Ford Company, it was running with more hands than ever before at that season. "There are now five hundred men at work in this plant," reported the Detroit *News* of February 3, 1908, "which number, it is expected, will be materially increased in the near future. Since January 15 about 150 men were put to work, and a night shift is also working."

Prospects for the company had never looked brighter. The Highland Park buildings were taking shape on the architects' draughting boards. Ford and his helpers were well along with their work on Model T, strikingly original in many ways, which would emerge as a completed car in October. When the directors met on April 30, they

were almost embarrassed by the plethora of profits. Couzens offered a motion, which on Dodge's second was carried unanimously, "That this company pay at once a dividend on the stock issued of 100 per cent, and a further dividend of 100 per cent between the 20th and 30th of each of the following months of May, June, and July, 1908." Not only was this $400,000 in dividends duly paid, but in the autumn $200,000 more was disbursed.[8] The original capitalization now seemed too small to impress the general public. In October, therefore, the stockholders voted to increase the capital to $2,000,000, divided into 2000 shares of a par value of $100 each; and ten days later the directors declared a stock dividend of $1,900,000 "out of the surplus."[9]

2.

The appetite for motor cars was worldwide. Imports of foreign cars into the United States, despite a tariff of forty-five per cent ad valorem, remained considerable. French cars in particular continued to enjoy a steady demand among those who wanted high quality regardless of price or who liked a foreign name-plate. But America too was beginning to expand its exports. Before the Ford Motor Company was fairly under way in 1903 it had sold its first Model A in England, and another in the Far East; and with the Model N and still more the Model T a worldwide popularity began to appear. In 1911 a traveller remarked with little exaggeration that any man might drive his Ford car around the world and stop every night at a garage handling Ford parts. Daughter companies were then flourishing in Canada and in Great Britain, while a foreign department occupied busy quarters at 18 Broadway, New York.

The founder of the Ford Motor Company of Canada was Gordon McGregor of Walkerville, Ontario, an experienced wagon manufacturer, sprung from a politically prominent and wealthy family, who had been quick to see the possibilities of Models A, B, and C for the Dominion market. On August 10, 1904, he entered into a contract with the Michigan company and Henry Ford by which he was to form a Canadian corporation with $125,000 capital, of which fifty-one per cent was to be allotted pro rata to shareholders in the parent Ford Company. It was thus that Malcomson and Strelow, among others, got their Canadian stock; thus, too, that Ford acquired majority control of the Canadian branch. McGregor further agreed to place that

organization under nine directors, a majority of them Michigan stockholders; to elect a president and vice-president from this same Michigan group; and to make the by-laws as nearly as possible conformable to those of the parent corporation. So control was to be kept securely in the hands of Americans, at least for the time being.

In exchange, the Ford Motor Company of Michigan agreed to furnish McGregor, without cost, all its Canadian patents; to supply all plans, drawings, and specifications for making its various types of cars; and to have Henry Ford, for a fair compensation, give sufficient guidance to automobile construction in Canada. The Canadian company was granted the sole right to make and sell automobiles within the Dominion and the other British colonies; and after December 1, 1907, it was to have a joint participation with the Michigan company in the British market. As changes and improvements were made in the Ford cars, the Canadians were to get the new designs free and to be protected against all infringement claims. Neither company was to sell in the other's territory. Assembly operations were at once begun in a one-story-and-loft building of the old Walkerville Wagon Works, handsomely situated on the Detroit River opposite central Detroit, with a fine view of the sparkling waters and Belle Isle Park. Though motors and transmissions were brought from Detroit, the wheels and bodies were made in Canada. The first car was shipped in February, 1905, and before the year ended the company, with sixteen employees, had sold 107 Model C's and 7 Model B's. Growth at first was slow. But the primitive quarters were gradually rebuilt and enlarged until in 1910 the fifty stockholders were delighted by a 100 per cent cash dividend.[18]

Meanwhile, an even more brilliant figure, Percival L. D. Perry, had taken charge of the Ford business in England. Reared in Birmingham, where he had attended King Edward's School as a scholarship boy, Perry found his ambition to study law frustrated by lack of funds. At seventeen, seeing an advertisement for a young man willing to do hard work, drudgery, in London, he responded to the challenge by selling his stamp collection to pay for a railway ticket, and took the pound-a-week job with a bicycle dealer named H. J. Lawson.* His employer was an enterprising man who had acquired the road rights for both the gasoline engine developed by Otto and Daimler, and the engine

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* The same Lawson who, as noted earlier, offered Duryea £40,000 for English rights in 1896.

of Panhard & Levassor. Taking a French car, the Bollée, as a model, Lawson built a small automobile driven by a horizontal four-stroke gasoline engine. This engine having been started, the car was put in forward motion by the simple act of employing a lever to tighten the propulsion-belt, and was stopped by jerking the same lever backward to loosen it! That Lawson had distinct mechanical talents there can be no question; his London friends even credited him with the invention of the safety bicycle, though Coventry has claimed the honor for one of her sons. When the Diamond Jubilee parade of 1897 was organized, Lawson obtained permission to place a car in it; and young Perry, dressed as a pierrot, was put in charge, alternately driving the car and then, for fear it could not keep going, helping lift it to a horse-drawn cart which was kept in readiness.[11]

Perry's interest in cars steadily grew. In 1898, when he was twenty, he used to drive a motor tricycle, the De Dion, from London to Hull, where he had an uncle and aunt, and where he met the future Mrs. Perry. He was continually stopped by the police, for in some villages and towns various minions of the law were still unaware of the recent repeal of the old requirement that a mechanically propelled vehicle had to be preceded by a man on foot, waving a flag. In Hull eager knots used to collect about the De Dion. Lawson, meanwhile, was helping to promote the Daimler Motor Company, one of the pioneer corporations in manufacturing cars distinctly adapted to the British market. For a time Perry went into the printing business in Hull with his uncle, but disliked the work, and presently returned to London, as enamored of automobiles and as sanguine of their future as ever. He was now a handsome young man, with regular features, thick black hair, keen eyes, and an alert bearing.

Sometime in 1904 a young Englishman whose father had sent him to the United States to get his rough edges polished off (Perry later called him a remittance man) returned with a glittering prize. He had met in New York the first export manager for the Ford Company, R. M. Lockwood, had bought three Model A's for sale in England, and had obtained a contract enabling him to sell Ford cars in all of Europe for five years on a franchise payment of merely £50 a year! Perry met him and others at lunch at the Albemarle Club, drove one of the cars with great satisfaction, and agreed to join in establishing the American Motor Car Company, primarily to distribute Fords in

the United Kingdom. Five partners subscribed £500 each and opened offices at 117 Long Acre, London. One was Herbert Stourton, scion of a prominent Catholic family, another was a partner in a well-known firm of wine merchants, and a third was a physician. Of this group Perry at once became the leader; he had the ardor, the capacity for hard work, and the knowledge of motors which were needed. They sold Models A, B, and C with consistent success, though all these cars were excessively noisy by English standards.[12]

Although it throve, the London agency was always short of funds. Cars had to be bought f. o. b. in Detroit, and only generous loans from the father of Perry's fiancée kept the partners afloat. A change of name took place in 1905, the agency becoming the Central Motor Car Company. In a frantic effort to obtain more capital the next year, two new men, named Thornton and Schreiber, were brought in. No sales possibilities were neglected. Perry imported three Model B's, for example, and put them on the London streets as taxis, the first landaulet cabs in the city. In doing this he had to satisfy the rigid requirements of the London authorities, who among other stipulations insisted that the cabs be painted *white* so that they would catch the eye of pedestrians and thus be less of a menace! But in spite of all his exertions, Perry could hardly pay the rent at Long Acre. He therefore broke with Thornton and Schreiber, and went to the United States in 1906 to try to persuade the Ford Motor Company to establish a full-fledged branch in Great Britain.

His experiences on this trip throw a fascinating ray of light upon the early figures and methods of the company. In New York he met R. M. Lockwood, the export manager. Dining with Lockwood at the Manhattan Hotel, he found himself a fellow guest with Charles H. Bennett, the Ford Motor Company stockholder of Daisy air-rifle affiliations; and the struggle between Ford and Malcomson being then at a critical stage, Bennett impulsively offered Perry his fifty shares in the Ford enterprises for eighty cents on the dollar, or $4000. In Detroit the young Englishman hastened to call on John S. Gray, as president of the company, at the German-American Bank, which struck him as a humble institution. One shirt-sleeved clerk was sitting with his feet on a desk, smoking a cigar. After some parley he waved Perry in to see Gray, who was also in his shirt-sleeves—"a dear old man." When the visitor sketched the operations and hopes of the Central Motor

Company, Gray remarked emphatically: "Well, I guess you'll have to see Henry." He placed Perry aboard a street-car, and the Englishman was soon alighting at the Piquette plant, where he found Ford and Harold Wills. Ford impressed Perry as being a rather complicated person with a streak of genius. Later Wills rode back to the center of town with Perry, dressed in his greasy work-clothes, which struck the newcomer as a bit strange; but Perry saw good reasons for accepting the current stories of Wills's talent.

The Fords invited Perry and his wife to stay with them in the modest house they still occupied on Harper Avenue; so modest, in fact, that every morning Perry and Edsel had a race for first occupancy of the bathroom. The furnishings of the Ford home were simple. Once in their talk some question arose which required reference to a Bible; the Fords searched for theirs, but could not find it. Both the Perrys thought Ford at that time a most likable person—"a man to whom you would give your last penny." He had an abounding spirit of fun, an impish, mischievous quality, which found expression in playing little tricks, never unpleasant; "he was a proper Puck," as Perry later put it. They were not always to hold this highly favorable estimate of him.

Of Couzens their impressions were from the start disagreeable. Obviously, he was an able business leader. "But," states Perry, "he was a spiteful man. If he had a chance to hurt anybody, to do some one a bad turn, he was delighted; if circumstances made it necessary for him to benefit another, he was surly." His fits of temper, usually heralded by the breaking-out of perspiration about his tightly-set mouth, were notorious in the plant. Once in later years, Perry, arriving in Detroit, bluntly asked Couzens, "Are you as nasty tempered as you always were?" Couzens retorted with equal bluntness: "Yes, I am, and I'm proud of it!"

It was not on this first trip, but a second two years later, that Perry found Norval Hawkins in the midst of his work of improving the business organization and practises of the company. His printed forms for various departments were still new. One day Ford and Perry were discussing motors, and Ford sent out for a certain part he wished to show the visitor. The man came back holding a form: "You'll have to sign this, Mr. Ford." Ford gave the employee a grim look, but signed the paper and received the part. Then he took Perry to the

office and asked the clerk in charge to see all forms like the one just used. A clerk brought them out. Ford called for the full stock, and when they came demanded: "Are these all you've got?" The clerk said they were. "Get me a can of gasoline," ordered Ford. He took the forms out to the testing-yard, poured the fluid on them, and set the heap afire.[13]

On his initial trip Perry crossed to the Dominion side to see McGregor—"one of the finest men who ever lived"; and since McGregor had the right after December 1, 1907, to sell Canadian-assembled Fords, substantially identical with the American cars, in Great Britain, the two had to discuss a division of territory. McGregor generously waived his British rights, saying that the remainder of the British Empire was territory enough for him!

Perry's first American visit established friendships; his second in 1908 resulted in the planting of a well-financed branch of the Ford Company at 55 Shaftesbury Avenue, London, with Perry as manager. Beginning with the Model T, cars were imported in considerable numbers—even a few Model K's—and at once found a ready market. Perry received a twenty-five per cent commission. With brisk enterprise, he set to work to create an organization of dealers throughout Britain, and soon had representatives from Plymouth to Aberdeen. With the chief Scottish representative, Henry Alexander, Perry saw to it that Ford cars were prominent in exhibitions and endurance contests.

In the last two months of 1909, Perry booked orders for 368 cars, selling to rich men who wanted a light car for country use, to doctors who found a small automobile cheaper than a horse, and to tradesmen. The feeling that only a French or German machine was "the correct thing" was being dispelled. That feeling had been strengthened by the almost complete failure of American cars in the chief Continental races, and by the fact that wealthy Americans travelling abroad generally used European cars and spoke contemptuously of American models. The whole automobile business was still hampered in Great Britain by a law which made it an offense to leave an automobile unattended or standing in one spot longer than twenty minutes.[14] But with more than sixty sub-dealers under Perry in 1910, distribution was steadily improving.

Meanwhile, H. B. White had taken charge of marketing on the Continent, with an office in Paris.[15] Although he had plenty of American

hustle, White seems to have understood that politeness and a careful study of each nationality in its own home were essential. In 1908 he was pushing the Model N all the way to the Russian border.* He liked to recall later how that year he tried to sell cars to the largest Prague automobile dealer, although the man spoke nothing but Czech, a language of which White understood not a word. He recalled, too, how he went to a French village of about 150 people and drove his car, loaded with people from all the countryside about, up and down a hill fifty times to prove its merits.[16] In Lausanne he got a foothold by selling four Ford landaulets to a taxicab company. Western Europe had been making good automobiles long before the Ford Motor Company was founded, but White persuaded his dealers that Models N and T were superior to anything made abroad at similar prices.

"America is Educating the World to the Automobile," H. B. Harper, the advertising manager, proclaimed in the *Ford Times* in 1910. What he meant was that the light, cheap, durable Ford models had found their way into remote parts of the globe that would have nothing to do with heavy automobiles. The first car sold in Turkey after the repeal of the law forbidding them on the highways was a Ford. A doctor in Barbados ordered a Ford; before long every other physician in the islands followed his example. In Kuala Lumpur in the Malay Peninsula a Ford agency was flourishing. The only garage in Newfoundland was that of a Ford dealer. Fords, wrote Harper, could be found in Greenland and in Mauritius:

> Naked little urchins on the narrow streets of Bombay dodge the rapidly moving cars. Scantily clad Ethiopian giants pilot tourist-laden Ford cars through the mining districts of South Africa. The Sphinx if he were to speak would comment on the horseless steed of vanadium steel that so frequently is seen before it. The slant-eyed natives of old China view with interest or alarm the noiseless vehicles that so quickly pass by. The narrow jinrikisha roads of the new Japan are being rebuilt. . . .

3.

"We are more than able to compete with foreign manufacturers,"

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* The United States [illegible] in *Motor World* of August 10, 19[illegible] light American cars, w[illegible] European automobilists [illegible] of the market by capable special representatives.

the president of the George N. Pierce company had said for the American industry in 1906. This was assuredly true of the Ford Company after the triumph of the Model T. When the Payne-Aldrich Tariff was written in 1909, an Automobile Manufacturers' Tariff Committee, on which H. B. Joy of Packard, A. L. Riker of Locomobile, and Benjamin Briscoe of Maxwell-Briscoe were prominent, labored amain—and successfully—to keep the forty-five per cent ad valorem tariff standing. Some wished it raised to sixty-five per cent. The two rival automobile associations worked in harmony on this subject. But the Ford Company, selling its low-priced cars all over the world, and on the highroad to a virtual monopoly of the market for cheap cars in North America, was indifferent to protection. Henry Ford was not on the tariff committee.[17]

The great opportunity of the Ford Motor Company for instituting a larger degree of systematization, progression, and mechanization in their work came with the consolidation of the Ford Manufacturing and Ford Motor companies early in 1907. Ford and his aides at once moved all of their better machinery from the Bellevue Avenue plant to the enlarged Piquette establishment; placed new machines, some of them specially designed, alongside the old; and effected a novel and better arrangement of operations. The change seemed at the time almost revolutionary, though it was really but a good beginning.

"When we moved in Piquette," recalled Max Wollering later, "we had to rearrange the whole business. The first step was to get our cylinder, crank-case, and crankshaft departments lined up. They were on the ground floor. That was heavy equipment and was laid out on the first floor. On the second floor again was the lighter machinery, and on the top floor was the assembly. Our raw material [that is, engine blocks and other heavy unmachined parts] would go from the first floor to the second floor to the third floor." Enough new equipment was bought, in some instances, to permit a doubling of operations. For example, the Bellevue plant had possessed the tools—lathes, multiple drills, milling machines, and so on—to turn one row of engine-blocks into finished motors; the revamped and broadened Piquette plant had sufficient machinery for two rows. Great pains were taken to stockpile the parts of the car in the most advantageous places. "Every piece of stock had its special place. If we needed any special racks to hold this material, they were built." While engines alone had been

manufactured at the Bellevue plant, at Piquette the company began making transmissions as well.

This removal, retooling, and rearrangement were begun, under the supervision of Ford and Wills, by Flanders and Walborn, but they did not stay long enough to get the improved factory into busy operation. The dynamic Flanders resigned April 15, 1908, taking not only Walborn but Max Wollering and the advertising manager, LeRoy Pelletier. Some employees got the impression that they did not like the Model N and the plan for Model T; that Flanders, like so many automotive engineers, preferred a more expensive and finely finished car. The main reason for their departure, however, was a tempting offer from the Wayne Automobile Company, which had obtained fresh capital and was planning a huge production.[18] As Flanders wished to create his own automobile business, he soon joined William A. Metzger, a one-time bicycle salesman who had later been sales manager for Cadillac, and Barney F. Everitt, manufacturer of automobile trimmings, in converting the Wayne concern into the E-M-F Company, which made an instant but precarious success, and then was merged with Studebaker. He had done much for the Ford Company, and the Ford connection had done much for his prestige.*

The departure of Flanders, Walborn, and Wollering compelled Ford and Couzens to promote a number of key men. Though the division of work was definite, formal designations of rank were as far as possible avoided. This was a continuing Ford policy, evidently designed to keep executives insecure, make them watchful of each other, and promote sustained competitive effort; all of which it accomplished—but at the cost in time of considerable intrigue, mutual jealousy, and an atmosphere of confusion. In effect if not in name, however, the portly P. E. Martin, a strict disciplinarian, now became plant superintendent, and the equally iron-handed Sorensen assistant superintendent. To Ford and Couzens they were "Ed" and "Charley." Wills

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* Flanders died June 16, 1923, at the age of fifty-two, from injuries in an automobile accident in Virginia. He was then chairman of the Rickenbacker Motor Company, but was giving most of his time to his estate near Williamsburg. Obituaries mention the frequently repeated [illegible] cars with [illegible] possible [illegible] tains a hi[illegible] because h[illegible] give him. [illegible] or stock.

remained chief engineer, his interest being more and more divided between design and metallurgy; besides a large salary, he continued to hold Henry Ford's oral promise, not completely fulfilled, of a share in Ford's dividends.[*] W. S. Hogue was kept as the capable head of the shipping department.[19]

Sorensen, who had previously risen to be head of the pattern-making department, was plainly on his way up the ladder. Lusty, able, and energetic, he had a flair for hard-driving command and a temper almost as fierce as Couzens's. "All hell broke loose when he became assistant superintendent," recalled one employee later; "he started out like a house afire."[20] As he rose, his dominating and domineering qualities became more pronounced; even his sister warned men not to rouse his anger. But he had a healthy respect for his superiors, and obeyed Ford implicitly.[21] His skill in making patterns which translated Ford's ideas into physical shape, and his willingness to accept these ideas without change—Wills was always trying to improve them—won Henry's liking. According to Sorensen, the two became comrades.

Just how far did the replanning and retooling at Piquette go toward the goals which Ford later reached in mass production? Mass production, it must again be emphasized, is much more than quantity production; it means the application to the manufacture of a given article of a half-dozen factors—simplification of design, standardization of parts, precision machining, carefully timed speed, continuous motion, and use of the most ingenious labor-saving mechanism. In the industry as a whole, erratic but real progress had been made toward this goal; and the Ford organization was shortly to carry the general movement forward with swift and accurate energy. How much had been accomplished by 1908, and what were the main lines of advance?

Since the new century began, a number of plants had been built for automobile manufacture with an arrangement of foundry, machine shop, and assembly rooms which permitted the orderly, systematic pro-

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[*] Ford later testified (November 16, 1916; Dodge suit) that he had an oral agreement with Wills under which "we have always divided up some of the profits"; that no percentage was ever fixed, but he sometimes paid Wills more than ten per cent, sometimes less. It seems impossible now to ascertain what payments were made. According to the reminiscences of E. G. Liebold (Ford Archives), Wills in the spring of 1917 felt that the agreement had not been properly kept, and made certain demands upon Ford. It was then agreed in writing that he should receive about $1,500,000 in three installments. We shall later deal with the sequel, in which Wills obtained a very handsome payment. He used to give part of his early dividends to Sorensen.

gression of work; beginning with raw material and coming down to the finished product. As pointed out in an earlier chapter, the original Olds factory in Detroit had shown a grasp of this principle. It had appeared in still more advanced form in the plant designed for Packard in 1903 by Albert and Julius Kahn. Great credit must be given to Albert Kahn, a worthy compeer of Louis Sullivan, Cass Gilbert, and Frank Lloyd Wright, but the tiller of a more obscure field, for his contributions to industrial design.* He accomplished a revolution in the planning of structures for the automotive and other industries almost as striking as the innovations of Wright in domestic architecture. Like Wright and Sullivan, he emphasized practical solutions of his problems, and in his later years his work combined a fine sense of form—which Charles Sheeler has caught in his paintings of Ford's River Rouge plant —with functional utility. Where he led, others followed. After the erection of the Packard plant, it was obvious that a large automotive factory ought to pool the ideas of executives, plant engineers, and a skilled architectural firm; and the Ford Company had grasped this fact in its plans for the new Highland Park plant. At the old Piquette works orderly progression faced severe obstacles; still, much could be done.

Machine tools, meanwhile, were showing—as experts like Oscar Bornholdt and Carl Emde well knew—a remarkable advance in connection with the automotive crafts. The car industry, a metal trades commentator had remarked as early as 1903, "has created an entirely new class of machine tools, which in the aggregate represent a considerable factor in the trade."[22] A decade later the *American Machinist,* reviewing the previous ten years, attributed to the quantity manufacture of automobiles many recent advances in standard and specialized machinery. "In no other field building a product of its size," declared this journal, "has the development of special machines and fixtures been carried out to such an extent as here."[23] As the bicycle industry had come to the rescue of machine tool builders after the panic of 1893, so the automobile sustained their faltering activity after that of 1907. A general overhauling of the industry followed the financial tempest; larger economies were plainly required; and as the manufacture of cars ex-

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* Sullivan, the father of American modernism, designed many great office buildings and banks, but was little interested in factories and other industrial buildings. Cass Gilbert also avoided the industrial field, and made free use of European idioms. See George Nelson, *Industrial Architecture of Albert Kahn, Inc.*, New York, 1939, and the *Architectural Forum* for August, 1938, devoted to Kahn's work.

panded in 1908, a tremendous demand for engine and turret lathes, automatic screw machines, vertical millers, radial drills, and other weapons in the panoply of modern machine equipment made itself felt. In 1910—to look ahead that far—it was estimated that more than 60,000 machine tools would be operated throughout the year to produce the automobiles demanded by the public. Wrote Isaac F. Marcosson:

> You have only to go to any of the great factories in Detroit, in Cleveland, in Buffalo, in Flint, or elsewhere to see the result of this hurry call for tools and machinery. You find automatics cutting the finest gears by the score, while one man operates a whole battery; you see drills doing from fifteen to twenty operations on a piston or fly-wheel; you see an almost human machine making seventeen holes at one time without observation or care.[24]

So much for factory-planning, and so much for the tools which carefully machined standardized parts; but what of continuous progression in the work? Up to the time that Ford consolidated manufacture and assembling in the enlarged Piquette plant, almost nothing had been done to promote such an objective. But now some small advances were made. Frank Bennett tells us of a travelling crane of elementary type. The date was the spring of 1908, which Charles Sorensen confirms as accurate:

> When I moved back into Piquette after the Ford Manufacturing Company was closed, they had a simple arrangement of a monorail. It was chains with trolleys so that if you wanted to hoist something or you wanted something over there, you just run it along on the trolley. They had wooden frames on castors because bodies can't be handled when they are painted . . . They can't be carried; they have to be rolled. Otherwise they would be all marked up.
>
> These bodies had to be lifted from that particular apparatus (the wooden frames on castors) to the chassis itself, and naturally that was done by crane work. They were hoisted up. You could have a monorail running this way or that. The motors were very heavy and of course that had to be done by hoist. It was still hand-chain hoist. They put the engines in any place, because. . . they still had the car sitting in spots. The car was never pushed to where the motor was. The motor went to the car.[25]

In brief, the hoists could be attached to the crane to carry the bodies or motors to this or that car standing immobile on the assembly floor.[*]

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[*] Such cranes were of course a long-familiar device in factories, and are not to be con-

An old story has it that in late Piquette days, when the company was about to move to the new Highland Park plant, the first primitive anticipation of a moving assembly line of cars appeared. Ford, "Ed" Martin, and Sorensen intended to install the moving line at Highland Park, and were anxious to test the idea. One company veteran has even furnished details:

> At the Piquette plant I remember that they built a line . . . out of railroad ties, iron slides, and some horses. They put the chassis on there [that *is, on the iron slides*], and they pulled *it with a rope. This was at the* Piquette plant.
>
> They made a long line, maybe twenty or thirty feet long, with the two rails. They put the front axle and the rear axle on it, and they slid it along so they could connect all the parts, that were necessary, the engine, brake, and other different parts. That was the start of the assembly line.[26]

A delightfully picturesque story this, which has been "corroborated" by one or two other Ford veterans. But through the haze of forty years any man's recollection of past events is untrustworthy. The fact seems to be that although some kind of rope-hauling experiment may have taken place, it was episodic, and that no genuine attempt to establish a moving assembly line was made at Piquette, or even in the first two years at Highland Park.

Photographs of the Piquette interiors in the spring of 1908 show the high mechanization of the factory and its general orderliness. One set of pictures presents the gear-cutting, crank-case, and screw-machine departments. A view of the room for engine-assembly shows nearly two hundred completed motors, ranged in neat rows. Finally, a photograph of the main assembly floor offers a vista of half-finished automobiles, about thirty in number, placed not end to end but side by side. Wollering speaks of the fact that "gravity slides were used quite a lot"

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fused with the carefully devised overhead conveyors (endless chains powered by stationary [illegible]

[illegible]

man can transfer the motor in its frame from the [chassis] assembling department to the testing brake, operate the brake, and deliver the chassis to the running gear department, where wheels, axles, and steering gear are fitted on." ("The Winton Plant and Its Product," *Cycle and Automobile Trade Journal*, VIII, No. 9, March 1, 1904, 66–79.)

before he left in the spring of 1908. This refers to the use of simple chutes to bring materials to the machine tools; though Wollering may also have had in mind the later practice of sliding the nearly-completed car down an inclined plane from the third floor to the ground, the body being swung into place as the machine descended.

Other large automobile factories of the time had come by 1908 to exemplify the same principles of planning, order, precision, and elementary continuity of work. Like the Ford plant, they took in pig iron, special steels, wood, leather, and other materials; hurried them through elaborate and difficult processes; and brought out the result as a shining endless row of fairly efficient vehicles. Absolute precision was not achieved; the metals were often all too brittle; the finished cars still broke down with annoying frequency. Nevertheless, a foundation was being laid. Hundreds of busy machines, many of them specially designed, hammered, cut, drilled, ground, and milled; hundreds of men toiled singly or in groups with the discipline of a little army; the right piece of material—gear-case, fuel-tanks, headlamps—arrived at the right spot at the right instant. A multitudinous activity which the casual onlooker found bewildering proved, on closer scrutiny, to be effectively modulated and controlled. One reporter in the closing days of 1907 described a large Detroit factory (not the Ford plant, for it had no production foundry), with emphasis on the unshaken continuity of the work:

> You go forward, always forward—and so does the material. There is no backing up, no lost motion. Pig-iron, steel, aluminum, brass and copper are dumped from the cars at one end of the factory and at once take up the march toward the shipping platform at the other extreme of the factory, each going along the particular channel prepared for it, all meeting again finally in the assembly room.
>
> The pig-iron goes to the foundry, from which it will emerge in the form of rough castings, which will be milled and bored and ground and polished until they are ready to perform their several duties in the finished car. Some of the brass, copper, and aluminum goes to other foundries, to also come forth as rough castings, which other machines will worry into shape. The sheet metal will go to the cutting and stamping machines, and the bar steel will hasten to those wonderful automatic machines that cut it into screws, bolts, nuts, gear blanks, and a great many other small parts. . . . The lines are all converging and when the several pieces come together at the meeting point they all fit one with the other, as though they had gone through the whole process side by side.[27]

Here, it will be seen, is no mention of any moving assembly line, but heavy emphasis on systematization and timing. An English manufacturer who visited the Jeffery Company's Rambler factory at Kenosha, Wisconsin, early in 1907, was struck by the same features. He noted the heavy inflow of raw materials, including 300 tons of brass alone; the completeness of the plant, which made nearly all its own parts; and the originality of the engineering, expressed in many exclusively designed machines.[28] Henry M. Leland's Cadillac plant was famous for the accurate standardization of its work and the efficiency of its tools. Its output was not large, about 9000 cars in 1909, but of the highest quality.[29] In a famous demonstration at Brooklands, England, in 1908, under the supervision of the Royal Automobile Club, three stock cars were torn down, their parts thoroughly mixed, and three cars rapidly put together again and driven off. No one in the country had a longer experience with shop practice than the elder Leland, a greater passion for accuracy, or a firmer commitment to the principle that economy demanded the steady scrapping of machine tools and their replacement by better devices. No matter how much a multiple drill or other tool cost, the Cadillac plant was quick to sell it at second hand the moment an improved type appeared.[30]

At Piquette, on June 4, 1908, the Ford workers broke all records in automobile history in meeting the final orders for the Models N and S:[31] during one ten-hour day they built more than one hundred (one hundred and one, to be exact) complete machines. No special effort had been made to achieve a new mark, and indeed, until mid-afternoon none had been anticipated. Shipments of seventy to eighty cars a day had previously been common, a remarkable pace for so congested a factory. One car that June afternoon was assembled and tested in fourteen minutes, a feat proving two important facts: first, that all the parts now fitted with sufficient nicety (in general) to make filing, hammering, or other last-minute touches unnecessary, and second, that a fairly efficient system had been devised for bringing parts up to the assembly line in just the right order and at the right time. As production of automobiles reached its height for 1908 in July and August, the schedule called for steady maintenance of the 100-car-a-day level. But Ford and his associates anticipated much higher levels as soon as they could move into the admirably designed and equipped Highland Park plant.

"The time is only measured by months," Ford shortly predicted,

"when this hundred-car figure will be multiplied by five." He would not have made such a prophecy unless he had possessed complete faith in the system and machinery of the new factory. His own machine tool designers—Wills, Galamb, Emde, Bornholdt all contributed—were doing as much as any to usher in a new production era. "From the manufacturer's point of view," declared *Automobile* on June 20, 1907, "there is little doubt that the most revolutionary improvement brought about by the automobile has been in machine tools." The magazine quoted one manufacturer, who might well have been Ford, as saying that within two years his company had scrapped practically every tool and replaced it with heavy new equipment capable of handling the new alloy steels, and of machining more complex parts with far greater precision and speed. Because his machine work cost so much, a manufacturer like Leland, Olds, Buick, Flanders, or Ford insisted on introducing improved methods and processes. Automobile men and machine tool manufacturers agreed that the automobile industry was doing more to advance tool design (and steel manufacture) than any other, or perhaps all others combined.

Planning, order, careful design of a factory as a whole and of each floor plan, ingenious focussing of materials, use of the latest machines —these were essential in any factory making a hundred cars a day. That mark had now been achieved. But if production was to be carried to five hundred or a thousand cars daily, two vital new elements would have to be added: moving assembly lines and numerous overhead conveyor lines, carefully intermeshed to give continuous flow to operations, and careful timing to keep this flow at the optimum level. Much had been done at overcrowded Piquette. With the coming transfer to Highland Park the way would lie open for the systematic inclusion of these two new elements in factory work, and for the mastery of everything implied in mass-production—the greatest of the achievements associated with Ford and his company.

4.

The house at which the Perrys had been guests to the Fords was at 145 Harper Avenue, not far from the Piquette and Beaubien plant. Although Perry later described it as modest, it commanded a rental of $60 a month and must have been a larger and more substantial home than Henry and Clara had known previously. However, by 1907 they

were planning to build a house of their own at the northeast corner of Edison and Second Avenues, a large plot of ground formerly the old Voight farm.

Louis C. Scott, who had married Nettie Bryant, Clara's double first cousin, and come to work for the Ford Motor Company, remembered in 1951 how Henry Ford had driven him out to Edison Avenue and pulled up by a house under construction. "Somebody is building this house," he remarked without a hint that it was his own; "I want to go through it." They did, very thoroughly. The men were putting on a green tile roof, and the carpenters were building cedar closets. "There is something, Lou," Ford remarked, "no moths will ever go into it." He then assigned Scott to "keep track of things" at the building.[32]

The house, designed by Malcomson, Higginbotham & Clement, was of red brick, with stone trim and a porch with stone columns. A garage at the rear was of the same materials and style. The interior was modern as to the plumbing and lighting, with tile floors and wainscotting in vestibules and bathrooms, and was decorated under Clara's supervision by the Harry J. Dean Company. The dwelling was spacious, with large living and dining rooms, a "den," three upstairs bedrooms, a kitchen, servants' dining room, and a butler's pantry.

It was worthy of the status the Fords had acquired, and the grounds were worthy of the house. For the first time Clara blossomed forth as a garden-lover. She employed a landscape architect; planted elms, purple birches, white pine, white birch, gray birch, magnolia, larches, Japan and Norway maples, oaks, and tulip trees; directed the construction of a sunken garden, a pergola, and a summer house; oversaw the laying out of hedges and lawns. With twenty types of roses she began her first rose garden, and made extensive plantings of other flowers and flowering shrubs and vines—wistaria, clematis, forsythia, lilacs, rhododendron. The total cost of buildings and landscaping appear in her records as $283,253.

The house and grounds required a staff of servants to operate them; these were procured, and the long simple era of the Ford's life came to an end. The new life was not easy in all ways, but it made possible many comforts and an enjoyment of interior elegance and outside beauty which the family had not previously known. On July 16, 1908, Henry purchased an electric car for his wife.[33] Louis Scott took care

of it. Clara used the vehicle for social calls and trips about town; for visits to Dearborn or more distant points she would go with Henry or Edsel.

Edsel, now in his fifteenth year, had registered at the Detroit University School at Congress and Woodward, a preparatory institution under private management. He too had a car now—a Model N. A lively youngster with a spirit of fun, he also had serious tastes. He was genuinely interested in mechanics and in the Ford Motor Company. His father had a workshop fitted up for him in the upper story of the garage. As a small boy he was forbidden the plant, but as a high school student he used to come in almost daily after school, swinging his books, which he would toss on George Brown's desk in the office near his father's with a "Hello, George!" Sometimes he would help Frank Klingensmith with the mail, addressing and stamping letters. More frequently he would head for the experimental room which Henry Ford maintained as a private preserve, to see what was going on there, and to give a hand if needed. Ford, if not in the room himself, would look for Edsel's books on Brown's desk, and if he saw them, would hurry over to join his son. He was pleased with the youth. "If that kid can only continue the way he is going," he used to say, "I've got one boy I can be proud of." Brown recalled that Edsel even as a boy was "a gentleman, quiet, genteel."[34]

Henry and Clara evidently tried to give Edsel the habit of keeping a diary, or he, seeing them and their little books, demanded and got one. The earliest dates back to 1907, a record book for automobile trips. Edsel started out bravely by recording the purchase of a Ford car, made one notation on a seventy-mile trip by his parents, and then quit. He had another diary in 1910, but made little use of it. With time, however, he did better.

The garage workshop had several power tools—a fine Hendey lathe with gearshift, a woodworking shaper, and other devices. Edsel accidentally took the tip of a middle finger off with the shaper. Henry often worked in the shop with Edsel, and Catherine Ruddiman, the daughter of Henry's sister Margaret, recalled how in 1909 she used to go to the garage and watch her big cousin. "I was just like a younger sister looking on." The Ruddimans recalled that in the evenings Henry and Clara would read aloud—she to him—or visit with friends, or Henry would "sit quietly and think," answering questions patiently if addressed.

In 1908 or 1909 Edsel became interested in aviation. The Wrights had flown at Kitty Hawk late in 1903, but were really not "discovered" by the public until their successful flights for the Army in 1908. Then, with the advent of Glenn Curtiss and others, the fact of human flight was revealed as if by a brilliant flash and stirred thousands of young enthusiasts. While in a minor way Edsel was one, far more ambitious was a young man of twenty at the factory, Charles Van Auken, who was working in Henry Ford's office, and urged his employer to build an experimental plane. Ford refused at first, and then told Van Auken to see what he could do with a Model T engine for motive power. Van Auken began work on a machine in the summer of 1909, and from his designs patterns were made for the parts. The fuselage was of wood and metal tubing, the wings of spruce covered with silk and linen. A tricycle landing gear was constructed, with two turntable wheels in front. The wings had no ailerons, and were warped to effect turns.

The plane, finished in about a year, was tested on the Ford farm at Dearborn, where a plank runway was laid out on a gentle slope. The plane rose about four feet from the earth, but was too heavy for its motor. After being lightened, it would hop at times to a height of six feet, then drop. During the tests the crankshaft broke and the plane was blown into a tree, with mild injuries to Van Auken, who was piloting it. Ford then ordered the trials discontinued, thus waving aside any opportunity to become a pioneer.[35]

5.

"We are working a full force not only on a day shift but on a night shift," announced the Ford Company as winter ended in 1908.[36] With all its activities burgeoning, the corporation began to face a manpower problem of real magnitude. The labor market in Michigan that spring was tight; at Lansing the Olds Company, for example, was hard put to obtain expert workmen to meet the rising orders, and was keeping its application department in Detroit open on Sundays.[37] The automobile industry as a whole, according to figures collected by the A. L. A. M., had employed nearly if not quite 60,000 men the previous year; and this meant a shortage of machinists, assemblers, pattern-makers, and finishers.[38] The average number of persons on the Ford Company salary and wage rolls in the year October 1, 1908–September 30, 1909, was 1387; for the following year it was to be nearly twice as many.[39]

One of the principal reasons why Detroit had become the center of the American automotive industry lay, beyond question, in the fact that it was an open-shop town, holding a strategic position for drawing labor from domestic and foreign sources. From the whole basin of the Great Lakes men migrated from farms and country towns to Detroit. Meanwhile, in the quarter century 1890–1914 a massive flood of laborers poured in from abroad, and particularly from Eastern and Southern Europe. By 1907 the "new" immigration from Italy, Hungary, Greece, and the Slavic lands made up more than four-fifths of the total, as contrasted with less than one-seventh in 1882. Much of this immigration could readily be diverted to such rising industrial centers as Detroit. The newcomers, without experience of an industrial environment, divided by numerous tongues and inured to poverty, provided a supply of cheap, docile workingmen; they had no craft traditions, and no acquaintance with trade unionism. Country boys from Ohio, Michigan, and Ontario were almost equally good material for the rising mass-production industries.

A sweeping technological change accompanied the rise of these industries—change which inescapably made obsolescent the skills, lowered the standing, and diminished the security of large groups who had previously borne the proud name of craftsmen. The metal-working establishments were especially prominent in this deterioration. A direct reflection of it appears in the statement of the Detroit local of the International Association of Machinists in 1896 that "the old all-around machinist is dying out," and in the decision of that Association to revise its constitution to grant membership to a large number of highly specialized machine operators: lathe hands, vise hands, floor hands, planer hands, milling-machine hands, and the like.[40] As specialization grew, until a man performed only one tiny machine process, the strength of the unions inevitably diminished.

Even had Detroit industrialists not been hostile to unions, the heavy immigration, the technological changes, and the recurrent depressions would have kept labor organization weak; but leading businessmen of the city from the beginning of the century showed the sharpest antagonism to labor leaders. Like nearly all other industrial towns, Detroit during the latter part of the nineteenth century had a number of vigorous craft unions—printers, iron-molders, coopers, and others They formed a succession of central city-wide labor organizations. The

one in existence in 1900 was the Council of Trades and Labor Unions; it was succeeded in 1906 by the Detroit Federation of Labor. The craft and other unions affiliated with this central body first rose and then fell in number and strength, reaching a peak of eighty-seven in 1904, and dropping to fifty-eight in 1910. The central city federation was associated with the Michigan Federation of Labor, a state-wide organization which, during the first decade of the century, also first rose and then declined in power. The most important craft unions at the beginning of the century were those associated with the metal trades: the iron molders' union, the machinery molders', the pattern-makers', the metal-polishers', and others. At first they seemed likely to flourish. But because of the technological changes just noted, a series of unfortunate strikes, and the vigorous mobilization of employers to promote the open shop,[41] they were gradually undermined, and in the end totally demoralized.

The valiant paladin of the open shop, the champion of the movement for making the city alluring to industry by keeping labor firmly abased, was the Employers' Association of Detroit. It was formed late in 1902 with an experienced foe of union labor, John J. Whirl, as secretary, and by 1904 had enlisted sixty-seven firms representing a wide array of industries. A brochure which it published in 1904 carried the revealing mottoes, "Prevention is better than cure," and "The greatest battles ever won are those which have never been fought."[42] Committees dealt with each of four important industrial divisions, the foundries, brass works, metal-trades, and boiler-works. Among the automobile manufacturers represented were the Leland & Faulconer Manufacturing Company (Henry M. Leland, long a bitter antagonist of unions, was one of the fathers of the E. A. D.), the Olds Motor Works, and the Briscoe Manufacturing Company; the Ford Company did not become active until 1910. The Association unquestionably had the practically unanimous support of the automotive executives of the city. The Reliance Motor Car Company, for one example, whose machinists all struck in the spring of 1905, was a violently anti-union corporation.[43] Other industries, however, were at first much more important in the organization.

"I doubt," wrote in 1911 the Detroit journalist Marshall Cusing, who published a magazine for manufacturers called *How*, "if Detroit could have been the biggest automobile town without the Employers'

Association."[44] He asserted that the E. A. D. was a product of desperation. It was formed, he said, because organized labor was "so drunk with power unopposed" that the employers had to defend their factories, their industries, their city. But whatever the provocation, some of the E. A. D. methods were those of men bent on economic absolutism. It was accused of compiling a secret blacklist of intractable workingmen, never to be given positions; of creating a reign of terror among honest, hardworking mechanics, who never knew when they might be discharged without cause; of keeping union men tramping the pavement for jobs until they knuckled under. It established a labor bureau which by 1911 listed thousands of "independent workingmen with clean records"—that is, non-union workers. It had an influence with the city government which according to opponents it did not scruple to use with tyrannical effect. It compelled liberal employers who were willing to hire union men for less than a sixty-hour week to toe the Association line.[45] Workers bitterly called it the Union Wreckers' Association.*

Inevitably, the success of the open-shop campaign and the frequent rigorousness of E. A. D. methods bred a resort to radicalism. Detroit was by no means the only industrial center of the day in which unions were being ruthlessly clubbed down. The well-established labor organizations clung to traditional weapons. But partly to champion the neglected cause of industrial unionism, partly to express radical ideas borrowed from the French syndicalist leader Sorel and others, the Industrial Workers of the World suddenly arose in the United States. Several delegates from Detroit bodies attended the Chicago convention of 1905 which founded it, but only the very leftist elements were seriously interested. The A. F. of L. and other old-line unions at once threatened expulsion for any members who became connected with the "Wobblies"; and the I. W. W. leaders, despairing of ever gaining sufficient strength to call strikes and boycotts, turned to propaganda. Actually they never made any real impression upon Detroit. They did come into conflict with the Detroit police, however, over the right to hold street meetings and parades—for the police were usually willing partners of the employers in curbing strikers and dispersing labor dem-

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* The files of the E.A.D., generously thrown open to the author, show that the charges listed above were exaggerated, and that its responsible heads had some sense of fairness. For example, its labor bureau listed union as well as non-union men, though it was doubtless careful where it placed the union members.

onstrations under the pretence of preventing "riots." In 1909 the severity of the police in stopping an innocent May Day parade led even the conservative Detroit *News* to expostulate:

> "Red Flag," "Anarchist," "May Day" and the like sound pretty revolutionary and seem to call for cordons of police, such as those we read of in dispatches from Paris and Berlin, but when these terms and phrases are connected with a few score poor Italians and woefully poor scions of other races, and the scene of the action is Detroit, a menacing display of drawn clubs and a spectacular charge of mounted men smacks of the ridiculous. The assault on these few score men was as unwise as it was unprovoked. . . . It is a strange thing that this FREE COUNTRY does not allow half the liberty in this respect that is enjoyed under the monarchial governments of Europe.[46]

The I .W. W. gave some passing apprehension to Ford Company executives, as to other Detroit employers, but except for its share in the great Studebaker strike in 1913, which did much to bring in a shorter work-day and which we shall describe later, it played no real part in the labor history of the city.

Between 1905 and 1910, while the Ford organization was rapidly growing, the Detroit unions were being thrown more and more on the defensive. Strikes to improve the lot of the worker became fewer; struggles for the very existence of collective bargaining grew frequent, and more often than not were lost. The State Arbitration and Mediation Court in 1905 pointed out that the open-shop issue was paramount in most labor controversies of the time, that employers had taken a firm stand on the question, and that in most instances the corporations were insisting that no arbitrable question existed. After a strike, employers would re-hire their men as individuals but not as union members.[47] Many unions were dying.

To no single date can we point with the words: "This was when effective craft unionism in the metal trades of Detroit gave up its ghost." Probably 1907, a year of half a dozen costly and disastrous strikes, best marked the turning point. One by one the principal unions—the machinists', drop-forgers', metal polishers', molders'—succumbed to the forces of the day. They never joined hands effectively. Even when most fiercely menaced by the Employers' Association, and faced with imminent death, their leaders failed to achieve unity. The reasons for this, however, are not elusive. In the years 1906–10 the

automotive industry was expanding so rapidly, native migration and foreign immigration in Detroit were so heavy, jobs were so plentiful, turnover was so frequent, and wages gave so much promise of increase, that unionism in the metal trades generally and in the automobile industry in particular was all but forgotten by most workers. To a devoted few it meant a great deal, but the adverse forces were too powerful to withstand.* The E. A. D. could well boast that "the open shop exists in Detroit as it exists nowhere else."

The Ford Company in these years had no strike confined to its plant, though it suffered from some of the general craft strikes. Its employees were as well paid as others in competing automobile plants, which meant that both skilled labor and common labor got a little more than in other industries. In 1905, according to the reports of the State Bureau of Labor and Industrial Statistics, the average pay of skilled workers in automobile factories was $2.45 a day, and of common laborers $1.74. Four years later the figures had moved up to $2.82 and $1.81 respectively; and in 1910 they stood at $2.91 and $1.97.[48] Careful statistical studies have shown that manufacturing labor as a whole in the United States suffered a loss in real wages during the two decades 1890-1910, the rise in pay being more than offset by the increase in living costs.[49] It seems certain that metal workers in the automobile industry shared this decline.[50] Nevertheless, in this occupation wages were not only higher than elsewhere, but had risen faster, and hope for the future was probably bright among most employees. Skilled workers, who in 1910 were classified as nearly three-fourths of those in the automobile shops,[51] did not realize that their status was about to change. The industry stood on the threshold of mass-production techniques, but it was not yet fairly inside the door.

6.

The working atmosphere in the Ford factory had become chillier and more impersonal even by 1906. Gone were the warmth and informal fellowship of the first two years, when Ford moved freely through the assembly rooms and took a hand in any job that presented

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* According to the report of Secretary Whirl at the seventh annual meeting of the Employers' Association, February [illegible] wage-earners about a q [illegible] ly 125,000 wage-earn [illegible] increased." (Minute [illegible] re than [illegible] thousand [illegible]

a knotty problem. To be sure, some reminiscences coming down from this period paint him as a lively, friendly good fellow who moved frequently among the workers, calling many by their first names and commanding their unswerving loyalty. No doubt such displays of comradely spirit occasionally took place, especially when one of the new models was being put into production; a great deal of personal supervision was then necessary, and a feeling of excitement and elation pervaded the place. No doubt, too, some favored employees, like Wandersee, received special attention from Ford. He, or someone near him, was by no means oblivious to the manifold values to be derived from a legend of intimacy, as an obviously inspired story in the Detroit *News* in 1911 shows:

> That a slap on the back is better than a call-down in promoting efficiency was proved by an incident in which Henry Ford figured the other day at the Ford Motor Company's plant.
>
> Mr. Ford was walking through the great machine shop, where the parts of automobiles . . . are made, and he happened to espy a big drill that glistened like a lieutenant's sword when a visit from the colonel is expected. Mr. Ford thought the machine must be a new one which had never been operated. He took a second glance and found that it was even then running, the man in charge of it being industriously at work. According to one of the department heads who saw the incident, Mr. Ford went over to the workman, and said, as he slapped him on the back:
>
> "Young man, I would hate to see you leave here, but if they ever should let you go, don't worry about another job, because any man that keeps his machine in the fine condition that yours is, is sure to come out on top. That is the best looking machine I ever saw in a big machine room."
>
> A few days later Mr. Ford passed through the same department and the glistening steel fairly blinded him. Every machine in the department was polished until it shone like a diamond. The slap on the back had spread.[52]

Actually Ford was too busy in the experimental department, after the first years, to spend time walking about the shop; the force soon grew too large, and its turnover was too great, for first names; and in succession Andrich, Flanders, and Martin expected a fairly free hand in dealing with workers. Real working conditions in 1906 are accurately reflected in a few surviving reports by a secret operative hired to work with and keep an eye on the men at the Piquette plant. He was not a labor spy of the kind already frequent in American indus-

rose, and the turnover was heavy (average employment in some automotive factories was said to be under eighteen months),[58] discipline was essential; the force had to be treated much like a little army. Couzens and Ford by 1908 seemed remote figures to the man [illegible] the multiple drill. It was P. E. Martin and Charles Sorensen to whom the men looked, and these superintendents tried to combine strictness with rough—sometimes very rough—justice. Employees were known by number, not name; each had to keep and wear a badge if he were to draw pay; timekeeping had become strict; rules were numerous and were stringently enforced.

But automobile workers did get somewhat better pay than hands in most other industries. Their hours were no longer; the standard workweek in American factories and shops down to 1910 remained sixty or at best fifty-five hours. It was to the credit of the Ford Motor Company that for a period of undetermined length between 1905 and 1910 it adopted a nine-hour day, only to revert until 1913 to ten hours again.* Work in the motorcar factories still had a good deal of variety, though that attractive feature was swiftly passing.

7.

As the new boom in automobile manufacturing developed in 1908-09, the industry was whirled forward on a surge of technological improvements and novel market demands, its leaders striving to supply popular requirements while introducing some striking innovations. The medium-priced touring car was enjoying a sustained vogue, for roads were being rapidly improved and middle class Americans were finding a new delight in country driving. The closed car, now that Fisher Brothers and other makers were establishing their factories, was becoming less uncommon. Many town cars with four-cylinder engines and cabriolet bodies were being sold at the $1000 level. Simplicity of design and engineering had been given impetus by the recent panic. Numerous manufacturers were attracted by the principle of the single chassis already adopted by Ford, and like him were trying to reduce the motor-system of the car to a few highly durable and dependable parts.[59]

At first the main American market for cars had lain in the region

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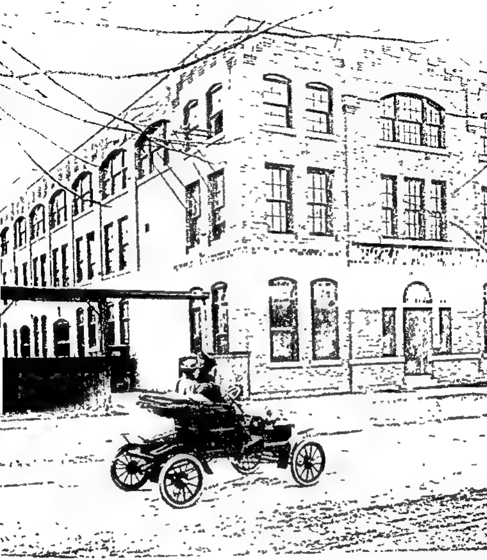
* Fair Lane Papers, Box 126, Ford Archives.



The Piquette Plant showing Model N about 1906

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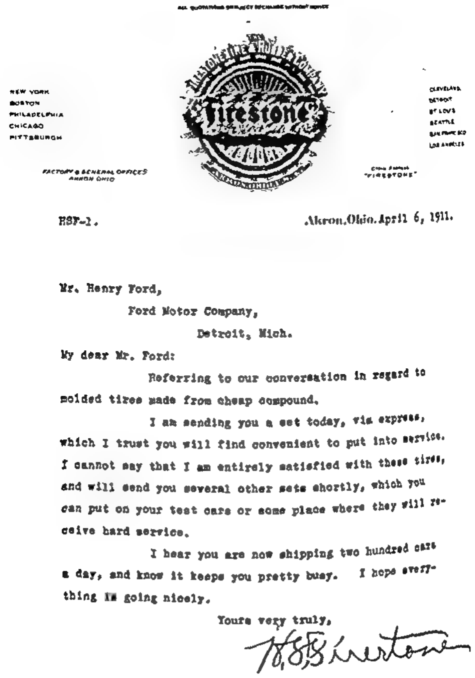
[*] Fair Lane Papers, Box 126, Ford Archives.

esidence of the Fords at
Edison Avenue

Residence of Henry and Clara Ford at 145 Harper Avenue

Henry Ford uses a watch to fascinate some children.



ALL QUOTATIONS SUBJECT TO CHANGE WITHOUT NOTICE

NEW YORK
BOSTON
PHILADELPHIA
CHICAGO
PITTSBURGH

FACTORY & GENERAL OFFICES
AKRON OHIO

CLEVELAND
DETROIT
ST LOUIS
SEATTLE
SAN FRANCISCO
LOS ANGELES

CABLE ADDRESS
"FIRESTONE"

HSF-1.

Akron, Ohio. April 6, 1911.

Mr. Henry Ford,
Ford Motor Company,
Detroit, Mich.

My dear Mr. Ford:

Referring to our conversation in regard to molded tires made from cheap compound.

I am sending you a set today, via express, which I trust you will find convenient to put into service. I cannot say that I am entirely satisfied with these tires, and will send you several other sets shortly, which you can put on your test cars or some place where they will receive hard service.

I hear you are now shipping two hundred cars a day, and know it keeps you pretty busy. I hope everything is going nicely.

Yours very truly,

H.S. Firestone

Harvey Firestone to Henry Ford in 1911—a letter indicative of the business relationship between the two men

east of Ohio and north of the Potomac; now the Mississippi Valley and plains states—the prosperous farming areas of the Middle West and Northwest—were equally profitable. One aspect of this Western rural demand was the rapid acceptance of automobile agencies by farm-implement and vehicle firms which had previously been indifferent to the trade. "Present prospects," said the *Horseless Age* early in 1909, "are that a large share of the low-priced cars will be sold through such outlets."[60] The better roads, the sustained prosperity of corn and wheat growers, the appearance of cheap cars adapted to rough country use, the fact that countless farmers were familiar with gasoline engines for pumping and woodcutting, all played a part in this change. Another aspect of Western demand was the sudden brief prominence of what were called "motor buggies." These were small, light, high-wheeled open cars, which a number of manufacturers hastened to place on the market. They made little permanent impression, for they proved undependable—"the motor buggy is now a magnet for mechanical incompetents," commented the *Horseless Age;*[61] but they did attest the interest of the rural population in cars of low speed, low cost, and low upkeep.

As Americans flocked to the automobile shows early in 1909, it was generally agreed that the industry, even discounting all its frenzied ballyhoo, enjoyed a bright outlook. One sequel of the panic had been the consolidation of a number of companies, with a resultant increase in strength. Another had been a marked reduction in the prices of nearly all parts, and of many finished cars, stimulating a marked expansion of business. A few conservatives, particularly in Eastern financial circles, still regarded the widespread use of the automobile as a craze. In 1909–10 several brokerage houses declined to bid on offerings of municipal bonds by Western cities, explaining that these municipalities had "too many automobiles in proportion to population" and were therefore unsafe credit risks. The bankers Spencer, Trask held up their hands in horror over a calculation that more than $300 millions would be spent for cars in 1910; "thousands are running cars who cannot afford to do so without mortgaging property," they declared, "while thousands of others are now investing in motors who formerly invested in bonds."[illegible] But the tide could not be stayed. One element after another in the population had found that the car was not a luxury, but a necessity, and the field of sale was steadily widening. "As soon

as a standard cheap car can be produced," predicted the *Nation*, "of a simple type that does not require mechanical aptitude in the operator, and that may be run inexpensively, there will be no limit to the automobile market."[63]

No limit to the market! That was precisely what a brilliant promoter named William C. Durant was telling various incredulous capitalists. It was what Henry Ford had long been assuring friends and associates —and the Ford Motor Company was about to prove it.

XVI

THE ADVENT OF MODEL T

On March 19, 1908, the first circulars describing the Model T, destined to be the most famous of all automobiles, were sent to Ford dealers throughout the country. They evoked a dithyrambic response. "We have rubbed our eyes several times to make sure we were not dreaming," averred a Detroit agent. "It is without doubt the greatest creation in automobiles ever placed before a people," declared the dealer at New Castle, Pennsylvania, "and it means that this circular alone will flood your factory with orders." Several agencies protested that it was a mistake to distribute circulars until the cars were almost ready for quantity delivery, for customers would become impatient. "We have carefully hidden the sheets away and locked the drawer," declared the agent at Rockford, Illinois.[1] It had been important, however, to give ample advance notice to dealers, that they might clear all the older models from their stock.

The unconventionality of the new car, its efficient adaptation to rough American highways, its correction of old faults, and its evident anticipation of several lines of future development in the motor industry, arrested general attention. Its body was lifted high above the roadbed; its ungraceful design somehow gave an impression of lithe toughness. The four-cylinder vertical engine generating twenty horsepower, the ample tank capacity (ten gallons for the touring model, sixteen and a half for the runabout), and the stout wheels and springs, suggested an ability to reach difficult goals. By an ingenuity little short of inspiration, the dry batteries of earlier models had been replaced by a magneto built into the motor; "every time the flywheel revolves," stated the company, "you get a series of sparks." For the first time the entire power-plant and transmission were completely enclosed. The weight of these elements had been correctly adjusted, with a three-point

suspension, and the entire car tipped the scales at 1200 pounds. Rear springs were attached to the ends of the axle housing. The four lamps were better placed. Vanadium steel of various types was used in crankshafts, axles, gears, and springs. With a wheel-base of eight feet four inches, the car was highly compact.

Its essential note was certainly utility, not beauty, yet its very homeliness had an appealing quality. The price was as yet not spectacularly low, ranging from $825 up. But the early advertisements swept that fact away in one sentence: "No car under $2000 offers more, and no car over $2000 offers more except in trimmings."[2]

Though deliveries could not begin until October 1, 1908, orders at once swept in like a torrent by mail, telegraph, and telephone. Couzens called the branch managers together in Detroit September 14-17. He had ready for them an optimistic report on the national and international business outlook, and Wills described the plans for making 25,000 cars in the next year. The enthusiastic managers demanded 15,000 cars for the fourteen branches alone. Immediately thereafter advertisements flared in the trade journals, prompting a new flow of urgent orders from general dealers. The company announced that every department of the Piquette factory was working full-time on parts and assembly, that the key divisions were employing double shifts, and that the 25,000 cars would be distributed on a fair basis. Branches and local agencies began to beat the drum as never before, using two- and three-column cuts of the model, and lifting a universal chant: "This car sounds the death knell of high prices and big profits."

2.

The Model T was the handiwork of a dozen men, among whom Henry Ford, Joseph Galamb, and C. Harold Wills were the most important. Ford must be named first, not only because he bore the principal responsibility, but because we have ample evidence that he contributed the guiding concepts and furnished the guiding hand. Of course, he knew all rival cars well, foreign as well as domestic (we hear of a Renault and later a Minerva imported for study), and borrowed ideas from them. In the main, however, the new model was an original product of the company's engineering group, with Ford as leader. Its basic merit lay in a hitherto unmatched combination of lightness, simplicity, and power; and its most striking features—the

improved planetary transmission, the light, strong rear axle encased in a steel housing with compensating gears in the center, the magneto, the springs attached to the ends of the axle housings, the use of vanadium steels, the splash-and-gravity oiling system—attested a highly ingenious planning talent. To be sure, it had numerous faults as well as virtues!

When Ford talked at the Piquette plant with the metallurgist J. Kent-Smith, and fully comprehended the possibilities of vanadium and heat-treated steels, the inspiration for the Model T dawned upon him. "Charlie," he told Sorensen, "this means an entirely new design requirement and we can get a better and lighter and cheaper car as a result." At Canton, Ohio, J. Kent-Smith showed him by laboratory methods the physical properties of various steels. Ford had special forgings made and tested. On his return, he walked into Sorensen's pattern department and said: "Charlie, come with me. I want to show you something." They went to the third floor; Ford pointed to available space at the north end; and he announced that he would build a new experimental room there. "We're going to start in on a completely new job," he declared.[3]

This little room was quickly built, its twelve by fifteen feet just large enough for the model, a milling machine, a drill press, and a few other power tools. Ford had previously asked Wills to find him two good draftsmen, one of whom, taken from the shop, was Joseph Galamb, carefully trained in Germany and at Westinghouse. Galamb, with his assistants, came up to a small separate cubicle adjoining the room. A blackboard was installed, and work began. While the door was kept locked the little group worked day and night on the new plans. Meanwhile, Wills undertook intensive work on special steels, fundamental to the new car, and travelled extensively.

"Mr. Ford first sketched out on the blackboard his ideas of the design he wanted," states Galamb. "He would come in at seven or eight o'clock at night to see how they were getting along. For about two years they worked on the design, and for over a year until about ten or eleven at night. Mr. Ford followed out the design very closely, and was there practically all the time. There was a rocking chair in the room in which he used to sit for hours and hours at a time, discussing and following out the development of the design."[4] C. J. Smith corroborates this. Ford, he recalls, was at the experimental room every

day. "He brought the ideas to us. First, he would think the thing up, then he would have them [the drafting men] draw it up, and then we would make it up." Young Smith had earned his entry into the experimental group. Hired as a machinist, he had been set to work milling cams; and perceiving how wasteful it was to machine each cam separately, he had put his cutter on an arbor and began milling eight or ten at once. Ford, noting his ingenuity, asked him to help with the advanced design, then under charge of Robert Grant. His associates included Wandersee and Degener, and they worked with enthusiasm:

> Our job was to get the advanced designs, the ideas that Mr. Ford and others would bring in to us, and actually put them together and test them. We would machine them all up, even get the castings and everything, and take them and build them in a car, and take the car out and test it. When we were working on the planetary transmission, we had quite a bit of trouble with the steel in the gears standing up. The gears wouldn't stand up because the steel was too soft. That was a problem that Wandersee worked on. . . . I myself worked on all the models. We developed the whole thing right there.[5]

Another veteran observer, George Holley, testifies that Ford used to bring in the various concepts of the machine he wanted, and then relied on his principal assistants, Wills, Galamb, and Smith, to give them practical shape. That is, he would *present* "the initial ideas," and they would "work out the details."[6] Often Ford would lend a hand with monkey wrench or drill.

When Ford began planning Model T, relates Holley, Galamb was the principal draftsman under Harold Wills's supervision, the drafting department at the Ford Company being exceptionally large in proportion to the whole plant. Ford would bring into the room a proposal, usually his own, but sometimes owing much to a rival machine or an associate, and Galamb would turn it into both blueprints and graphic sketches.[7] Sometimes Ford, scanning the diagrams, would seize a pencil and draw a rough, amateurish sketch himself. "I've seen him make many a sketch," declares Fred Rockelman.[8] Thus, without discouraging Galamb, Smith, and the rest, he would get them to discard an imperfect design and start again. By 1906 he had begun having his drawings and those of Wills and Galamb put on a blackboard, both for easy full-scale study and for photographs—for he had learned

from the Selden case that in a patent suit such photographs might demonstrate prior rights.[9] When blueprints were ready, parts were cast, machined, and put together; indeed, the quick-witted Sorensen, hearing Ford offer an idea, often made a pattern and casting without waiting for a blueprint. Like other engineers of that period, Ford liked to construct a working model on John Fritz's principle: "Let's start it up and see why it doesn't work." Indeed, no automotive engineer could be sure simply from reading blueprints (at which Ford was weak anyway) that he had an efficient machine; to grasp all his problems, he needed at least a wooden mock-up.

As the work of design progressed, Ford grew enthusiastic. "Charlie," he would say gleefully to Sorensen, "we're on the right track here now. We're going to get a car now that we can make in great volume and get the price away down."

Galamb, who insists that Ford's ideas were dominant in the Model T, defines its fundamental character as Couzens did years later in a lawsuit:[10] the combination of lightness with power and durability. Other manufacturers grasped the same concept, but Ford knew how to realize it in what Galamb says was "really a revolutionary product."

In this product the use of vanadium steel and of special heat-treatments, which Wandersee and Degener had developed, did much to solve the problem of strength in lightness. The improved planetary transmission was also of cardinal importance. At that period countless Americans did not know how to shift gears, and since the metal in the transmission was soft, gears were often stripped. The fact that many clutches were heavy and sticky made shifting specially difficult for women. Much of the public was eager for a transmission which could be easily handled without damaging the mechanism, and it found the well-designed planetary system of the Model T a refreshing change.* The three-point suspension of the motor, as yet a novel idea, was equally important, especially in the innumerable areas of bad roads. It avoided the distortion of the motor base common with a two-point suspension, and was soon adopted by other manufacturers. The detachable cylinder head which Ford installed was also a valuable innovation. Many car-makers ridiculed it, asserting that it was impos-

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* Throughout the work careful tests of the steel had to be made. Sorensen writes in his reminiscences (Ford Archives): "The transmission in itself was an interesting picture of how Mr. Ford wanted this analyzed. It was a planetary type of transmission, and at times it was astonishing to me to see how well he sensed the sizes required for these different gears."

sible to cast a separate cylinder head that would not leak; but within a half-dozen years they were following Henry Ford's example. The arc springs of the Model T, while affording no luxurious cushion, did free the entire body and chassis from the racking torsions then common in most cars.[11]

As for the simple, workable magneto, Galamb makes it clear that this was Ford's creation. "Mr. Ford said we must put it in the flywheel to supply current for ignition and the lights. We first tried to make it in one piece but this proved impracticable, and at his suggestion we then made up sixteen magnets separately, charging them, and then built up the whole circle."[12] As carefully worked out, it required few subsequent modifications. Two carburetors were used: one designed by Kingston, the other by Holley the Pennsylvanian who had once manufactured motorcycles. Called in by Ford and Wills, he made a new carburetor that they liked, and later set up a little factory on Rowena Street in Detroit to produce it for the Model T. Making it at first of brass, he found his costs excessive, and then devised a much simpler, lighter, and cheaper carburetor of iron. Ford had bought the Rowena Street plant, but presently handed it back to Holley along with an order for a full supply of carburetors—an order which in the end meant the sale of more than sixteen million. He remarked as he returned the factory to Holley: "This sale and purchase is just like this watch charm I wear; I can take it off and put it on."[13]

That Wills, Galamb, Degener, Smith, and others had great technological experience and talent there can be no question. It may well be true that the planetary transmission owed much to Wills, the apt use of new steels to Wandersee, and the special device for splash-and-gravity lubrication to still other men. The precise authorship of a number of other innovations in the Model T we shall probably never know. Just who is to be credited with the efficient design for the three main bearings? For the gear-driven fan? For the carburetor adjustment on the "dashboard"? For the spark and throttle control under the steering wheel? Some of these improvements belonged not to the Ford Company but to the broad advance of the industry. Nevertheless, when all allowances are made, we must repeat that general credit for the Model T unquestionably goes to Henry Ford. His was the controlling plan for a light, powerful, trustworthy cheap car; his was

the guiding mind; his was clearly the most powerful personality. We might be tempted to fall back on the usually accurate theory of social invention, but all the survivors of that era who have left reminiscences agree as to his leadership and his paramount contributions.[14]

In some mechanical matters, men then—as later—found in Ford an extraordinary power of divination. He was quick to see precisely how an adjustment of parts could be bettered. When a problem of thickness of materials, distribution of weight, or tensile strength arose, he sometimes solved it by sheer inspiration. A university-trained engineer with precision instruments and slide-rule could make computations far beyond him, but he had an instinct which left expert engineers wondering at his superior insight. Here lay his genius. In most other matters he was a shrewd, skilled, but undisciplined and, in some respects, ignorant mechanic; his faults of taste and temper were so evident that a perceptive observer like Percival Perry wondered uneasily as to the use he would make of the great power gathering in his hands. But in dealing with the challenge presented in the production of Model T—the tremendous challenge of designing cheap, efficient transport for the masses of America and the world—he had just the single gift required.

Once the feat was performed, he was exultant. The day the first Model T was brought out of the experimental room, and (after some last-minute tinkering with a stuck transmission) set running, was a day to be celebrated. Ford asked George Holley to take him downtown. They traversed all the main streets—Woodward Avenue, Michigan Avenue, Lafayette. With the vindictiveness that was as ingrained in him as in an Indian, he took special pains to go past Alexander Malcomson's office. Throughout the ride Holley found Ford as pleased as a boy with an athletic prize. To another worker, George Brown, he seemed "tickled to death." He bubbled over with exuberant joy. "Every time he'd meet somebody, he'd give him a kick in the pants or a punch between the shoulders." Looking around a circle of his associates in the plant, he grinned happily and ejaculated: "Well, I guess we've got started."[15]

3.

They were started indeed. Once loosed, the cataract of orders never stopped. The wave of enthusiasm for the new model rolled across

America and round the world. At the Olympia Show in London in 1909 the two sensations were the Model T from the Middle West and the new Darracq from France,[16] both low priced and both conspicuously well made. Other striking cars were brought out in 1908: the large Buick Model D at $1750, for example, of which Buick manufactured 543 that year, and the little Maxwell two-cylinder fourteen-horsepower runabout at $825.[17] None, however, combined anything like so many new features as the ungraceful, bouncing, noisy, tough-looking, and endlessly useful new Ford.

The faults of the early Model T's, as we have suggested, were numerous and painful. One weak point was the bearings on the rear axle, made during the first year of babbitt metal; pounding on the road elongated them, requiring frequent replacements. Roller bearings, as we shall see, were introduced the second year.[18] The transmission bands gave users constant trouble, for the lining easily burned out until a better fabric was employed. Complaint arose over the fact that front and rear wheels were of different sizes, which necessitated carrying double sets of tires and tubes.[19] The rear seat of the touring car was too narrow, an addition of a few inches presently sufficing to accommodate three instead of two persons. Riveting had to be bettered, and appropriate steps were quickly taken. By 1911 fore doors for the touring car, missing in those first made, were available for ten dollars a pair.[20] Starting the Model T, especially in cold weather, was a source of innumerable broken arms and endless profanity; and we find the company suggesting that owners with cold garages attach an electric light to a long cord and keep it burning under the hood to keep the motor warm.[21]

Many of the special features of which Ford dealers made much seem quaint today; the hand-lever employed to reverse the machine, for example. But wherever the Model T went curious groups gathered to gaze and confident owners paused to point out its advantages. The left-hand drive, for example, for both the Model N and Model K had kept the right-hand drive; the lever just under the steering-wheel which controlled the flow of gasoline; the double system of braking, hand and foot; the extra-large springs; the good leather upholstery. Early buyers were able to get touring cars painted red, and roadsters in gray, but beginning June 1, 1909, all model T's became a Brewster Green with black trimmings and red striping. The company was too

busy turning them out in quantity to bother about different styles of painting.[22]

The faults and merits, the graces and gaucheries of the early Model T have been hymned by many writers who fell into alternate moods of exasperation and rapture as they dealt with its temperamental, skittish ways, but who almost unanimously cherished an intimate affection for the unpredictable creature. No two cars were quite alike. Mastery of any one involved highly personal qualities of courage, skill, intuition, and luck. As of Cleopatra, it could be said that time could not wither nor custom stale the infinite variety of the flivver; with all its superior dependability and simplicity it combined an arch and mercurial eccentricity. It was more like a human being (of feminine gender) than any other car ever known to man. To buy one was to embark on a great adventure:

> To get under way [writes Lee Strout White in his classic tribute] you simply hooked the third finger of the right hand around a lever on the steering column, pulled down hard, and shoved your foot forcibly against the low-speed pedal. These were simple, positive motions; the car responded by lunging forward with a roar. After a few seconds of this turmoil, you took your foot off the pedal, eased up a mite on the throttle, and the car, possessed of two forward speeds, catapulted directly into high with a series of ugly jerks and was off on its glorious errand. The abruptness of this departure was never equalled in other cars of this period. . . .
>
> The driver of the old Model T was a man enthroned. The car, with top up, stood seven feet high. The driver sat on top of the gas tank, brooding it with his own body. When he wanted gasoline, he alighted, along with everything else in the front seat; the seat was pulled off, the metal cap unscrewed, and a wooden stick thrust down to sound the liquid in the well. There were always a couple of these sounding sticks kicking around in the ratty subcushion regions of a flivver. Refueling was more of a social function then, because the driver had to unbend, whether he wanted to or not. Directly in front of the driver was the windshield—high, uncompromisingly erect. Nobody talked about air resistance, and the four cylinders pushed the car through the atmosphere with a simple disregard of physical law. . . .
>
> . . . The Fords were obviously conceived in madness: any car which was capable of going from forward into reverse without any perceptible mechanical hiatus was bound to be a mighty challenging thing to the human imagination. Boys used to veer them off the highway into a level pasture and run wild with them, as though they were cutting up with a girl.[23]

As the flood of Model T's swept in, the last of the Models N and S disappeared from the showrooms. As for the expensive Model K that Ford had always disliked, those that remained were cleared by sales at $1800, a thousand dollars below list price.[24]

4.

Success with the Model T, as we have said, came in like the flush of spring greenery. The summer and fall of 1908, indeed, found sunshine irradiating the entire automobile industry. Like the Ford Company, other Detroit makers were enlarging plants, installing more machinery, and hurriedly hiring men. Good toolmakers and other expert mechanics had become rarities on the market. In mid-September the press reported that various car factories were each employing scores or hundreds of additional hands—Cadillac, for example, 500 to 600—and that the Ford Company would lead all others.[25] At Piquette almost frenzied preparations were made. "Ed" Martin, with the help of others, revamped the plant; Sorensen, his blond hair tossing and his blue eyes burning, improved the general floor layout; Oscar Bornholdt listed in detail the new machine requirements. Operations sheets were prepared for all the parts to be made in the factory, and these sheets thereafter became the key to purchase of equipment and the guide to the designing of novel tools. For the first time, Ford, Martin, and their aides instituted a really efficient system of stock control, and erected it into a separate department. The production of the Model T was to be an epochal new operation, and the factory throughout the year 1908 was like an army mobilizing for war.

Before May 1, 1909, the Ford executives announced that they had enough orders for the Model T to consume the entire factory output up to August and would temporarily accept no more. The public had called for four times as many touring cars as roadsters, and as the company could not make that many, it asked dealers to change their orders as much as possible. Nor could the company make an absolute promise to ship dealers all their consignments in August. Not until July 7 did the company again begin taking more orders.

Nothing delighted Henry Ford so much as the rapid acceptance of the Model T by the rural population. For years most farmers had shown a stubborn dislike for automobiles, which scared horses, killed poultry, and sometimes (as Woodrow Wilson noted in a speech made

when he first entered politics) flaunted idleness and conspicuous consumption in the faces of hardworking, hard-pinched men. To the farmer, said the *Motor World* of February 26, 1903, a car was a "natural enemy." The Model T, however, was democratic, inexpensive, and useful, and this pleased the erstwhile farmboy at Highland Park. "Mr. Ford always had it in his mind to make the farmer's lot easier," remarks Fred Seeman in his reminiscences. "He always came in and talked to me about it. . . ." Already he was thinking of a tractor.

"We are building and shipping more cars than at any similar period in our business," the company stated May 1, "but the orders have already reached a total in excess of any previous entire season's business."[26] The summary of operations for the year ending June 16, 1909, though negativing any idea that three thousand to five thousand new men had been employed, was by far the best yet published:[27]

Factory Space: Twelve Acres	Cars Built: 10,660
Average No. Employees: 2190	Branches: 22

When the branch managers held their annual meeting in Detroit early in November, 1909, the company informed them that during the past year it had done a gross business of more than nine million dollars,[28] three-fifths greater than in the previous year. The number of cars sold for the year October 1, 1908–September 30, 1909, was 10,607.[29] This was despite the fact that the great volume of Model T's had not been available until spring. All forecasts for the year ahead were optimistic. Several dealers, after visiting competitive factories in the medium-priced field, were convinced that the Ford Company had at least a year's start over them. Couzens and Ford assured the gathering that contracts had been signed assuring a full supply of raw materials for the coming year; that deliveries of materials were already being made; and that the company expected to make prompt shipment, on prearranged monthly schedules, of all the cars the trade would order. Both plant and operations were steadily being enlarged. Since August, for example, the company had been making its own radiators.[30]

One order for materials was particularly striking: a contract in February, 1909, with the United States Steel Corporation for 2100 tons of vanadium steel to be supplied from its Canton, Ohio, plant in three grades: a medium tensile strength for axles, gears, and forged parts,

a high tensile strength for springs, and a core-hardened steel for other elements.[31] Contracts with George Holley for his simplified carburetor were being extended. Ford had discouraged the young man from taking out patents (for since the Selden patent suit Ford disliked patents on principle), saying: "Go ahead and make a better job."[32] Bearings were coming from the Hyatt Roller Bearing Company at Harrison, New Jersey, which had long been supplying the Olds, Cadillac, Buick, and other companies,[33] and which had made bearings for the rear axle of the racer 999. The enterprising manager for Hyatt's was a graduate of the Massachusetts Institute of Technology in the class of 1895—Alfred P. Sloan, Jr., a homely, bulging-eyed, big-eared bundle of energy destined to write his name large in the history of the automotive industry. He often visited the Ford plant, became a friend and admirer of C. Harold Wills, and labored indefatigably to keep his own factory abreast of the automobile industry; toiling for four consecutive years, he tells us, from 8:30 to 6, six days in the week.[34] His works, like Ford's, made extensive use of vanadium steel.

Since the spring of 1906—that is, since the irrevocable decision for the cheap car and the ousting of Malcomson—the Ford factory had depended for tires largely on an Ohioan whose enterprise matched that of any industrialist in the country: Harvey S. Firestone. The Firestone Tire & Rubber Company of Akron dated back to 1900, when it had launched a small factory making solid rubber treads for buggies, carriages, wagons, trucks—and automobiles. Firestone sold his "solids" to Maxwell, Premier, White, Stanley, and other car manufacturers. Before long he turned to pneumatic tires; and he at once encountered the opposition of the Clincher Tire Association. This was *nominally* a body of patent-holders for the clincher type of tire (rubber beads, held in place by air pressure, clinching turned-in rims), but actually an agency controlled by the United States Rubber Company.[35] Firestone's application for a license from the association was rejected. He at once cast about for an improved method of fastening the tire to the rim. In 1905 he found the invention he wanted, developed it at his factory, and began making pneumatic tires equipped with riveted plates and bolts by which they could be secured tightly to the wheel without danger of pinching. "Not a substitute for the clincher," he advertised, "but its superior." Trebling his plant facilities and raising the number of his employees to 130, he exhibited the tire at the New York and other automobile shows early in 1906.

As he did so he heard of Ford's plan for quantity production of a $500 runabout. Visiting Detroit, he found the Ford Company in a receptive mood. The clincher-tire manufacturers, believing they controlled the business, had submitted uniform bids at the monopoly price of $70 for each set of four two-and-a-half inch tires. This irritated Couzens and Ford, anxious to keep costs to the lowest level. Moreover, ever since the A. L. A. M. had rejected Ford's license application and initiated its suit against the company, the Ford executives had sympathized with other battlers against patent-holders. Ford placed a number of Firestone tires on cars and gave them exhaustive tests. He and Wills became convinced that the new straight-side pneumatics, mechanically fastened, were really superior. Negotiations followed.

In March, 1906, the Ford Company placed with Firestone the largest single contract for tires yet signed by an automobile manufacturer, ordering 2000 sets at $55 a set.[36] Delivered in April, they were to be followed, if satisfactory, by 4000 more in May and 2000 in June. The inevitable delays ensued. It became evident that until Firestone enlarged his distributing system, replacements of the mechanically-fastened tire would not be available on an adequate scale. Meanwhile, the Ford Company delayed the manufacture of its cheap Model N. Thus it was that not until 1907, when Firestone was making a full line of both clincher tires and bolted tires, and when the Ford Company shipped out its new model in large quantities, did the alliance between Firestone and Ford become fully effective. The business confidence established between the two men was quickly supplemented by a warm personal friendship: they had first met ten or eleven years earlier, when Firestone, a carriage salesman visiting Detroit, had persuaded Ford to buy four carriage-tires,[37] and now they saw each other with some frequency. But the Ford Company did not make the error of giving all its tire business to Firestone, nor did Firestone fail to sell both solid and pneumatic tires *to a wide variety of firms.**

* Wheels for the Model T were supplied by various makers. The Kelsey Wheel Company [illegible]

Kennedy of Kelsey's, June 2, 1926, Additional Tax Case.)

5.

As success came with the Model T, the business and sales organizations had to be improved. Both were still in rudimentary form when the new car was introduced. Couzens, a martinet who believed in hard work no less than in rules and system, had always been reluctant to enlarge his staff. Klingensmith's accounting department, which oversaw receipts and expenditures, had only nine or ten employees at the beginning of 1908; LeRoy Pelletier's advertising department was still tinier; and the sales department counted only a half-dozen men. In the offices, the rule of a ten-hour day and six-day week (general at that time in American business) represented only a minimum. Overtime was frequent, and as papers accumulated in the busiest seasons everyone from Couzens down might be found toiling even on Sundays and holidays. The boss set the pace. Two photographs of the offices of Couzens and Ford published in 1908 are revealing as to the habits of the two men.[38] Ford is sitting relaxedly behind a small flat-top desk, plainly uninterested in the few papers on it; his waste-paper basket is empty; he is ready to talk with an engineer, or to walk into the shops. But Couzens, braced at a huge roll-top desk, its pigeon-holes stuffed, with numerous papers under his elbow and other documents and books on a table just behind him, is writing busily, immersed in work.*

One clerk hired in the spring of 1907, George Brown, recalled long afterward that he had to hurry the installation of a telephone in his house, for without it his wife would never have known whether to expect him home at six or at ten. Often, taking a bundle of papers to his house, he would work on them until two or three in the morning, getting back to the office again at eight. Often, too, Klingensmith would thrust a doleful face in at the door late in the afternoon, lamenting: "Gee, we're stuck again!"—and everybody would hammer away under the glaring electric lamps until late at night. At the end of the month night-work might last for ten days as they scanned accounts, studied vouchers, and paid bills.[39] The Model T made this

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* Frank Bennett states (*Reminiscences*, Ford Archives) that Couzens was disliked by many of the force. "I called Couzens 'Sunny Jim' because he was so God damn mean." *He gives an* instance of Couzens's "meanness"—he wanted to discharge Bennett because he quite wrongly suspected him of using a company car for a Sunday excursion; and although the discharge was prevented, Bennett went over to the Packard plant in a huff. But Couzens's insistence on rules was in general justifiable.

primitive kind of business office impossible. The first advertisement appeared on a Friday. "Saturday's mail," records the *Ford Times*, "brought nearly 1000 inquiries. Monday's response swamped our mail clerks, and by Tuesday night, the office was well nigh inundated."[40] The staff had to be swiftly augmented.

The rising tide of orders required both expansion and systematization of the marketing arrangements. Dealers, who now came hat in hand, were soon a small army, and had to obey orders like one. They were told that they must sell all of the earlier models on hand before they could deliver a Model T to a customer, and that they must give evidence of booked sales before even one Model T was shipped them. The number of branches, as distinguished from mere dealerships, had to be increased. In the summer of 1909 the executives announced that business had so far outgrown the eleven branches that six to ten more would have to be opened in the next year.[41]

With the rapidity characteristic of Couzens, capable men were hired, buildings rented, and branches planted in strategic positions. During the last quarter of 1909, five were established—in Atlanta, Pittsburgh, Dallas, Cincinnati, and Omaha. The first quarter of 1910 saw branch garrisons occupying new posts, until the twenty-fifth raised its flag in Fargo in March. Usually a veteran dealer, like M. C. Huie of Atlanta, was chosen to head a branch. Sometimes a salesman was taken from an earlier branch; the Chicago branch, for example, trained the managers for Indianapolis, Fargo, and Omaha. Usually, too, the premises needed were leased, but now and then they were bought. The corporate laws of various states made it necessary for the company to appoint agents with power of attorney in California, North Carolina, Louisiana, and other places, and these were for the most part branch managers. Everywhere the branch managers were authorized to take general control of sales within a specified territory; that is, to make contracts with dealers and agencies (who fell into several different classes), to sign agreements with buyers, and to execute bills of sale on printed forms supplied by the company. They were strictly forbidden, however, to cancel any agency contract, that power being retained by the company.[42]

Ford branch houses were situated at strategic points where freight rates changed, affecting shipment costs. As the branches grew numerous, they gave a much better control of the company business

throughout the country than the use of wholesale distributors. Each branch could closely supervise the dealers in its territory to keep standards of service high. In addition, the system furnished absolute control of prices of cars, parts, and accessories. All branch houses were adequately stocked with parts to supply the territories under control. The percentage of the sales handled by the branches steadily climbed. In the fiscal year ending September 30, 1909, the Detroit offices (factory) sold $3,413,000 worth of cars and parts; the branches sold $5,628,000—that is, 62.2 per cent of the whole. For the fiscal year 1910 the Detroit office sales were $5,529,000, and the branch sales $11,182,000—or 66.9 per cent of the whole. For the fiscal year 1911 the Detroit office sales were $7,545,000, and the branch sales were $17,111,888, or 69.4 of the whole. And for the fiscal year ending September 30, 1912, the Detroit sales were $11,590,000, and the branch sales were $30,888,000, or 72.7 per cent of the whole. Then in the year ending September 30, 1913, the Detroit sales reached $18,857,000, and the branch sales $70,252,000, or 78.7 per cent of the whole.*[43]

Nothing that the Ford Company had done pleased the average automobile owner more than its policy with respect to the servicing and repair of cars. At an early date it had furnished price lists of parts to consumers—then an unusual enterprise. More parts lists were then put out unpriced by automobile manufacturers than almost any other type of merchandise sold in that way. The Ford Company also sent out travelling agents who taught the Ford dealers how to handle stocks of parts, how to do repair work, how to use the best tools in repair, and so on.[44]

To view a not untypical branch, let us walk into the quarters of the Ford Company on Race Street, Cincinnati, as they stood in 1910. Here was a four-story stone and concrete building, its thirty-six foot frontage on the first floor largely given up to a plate-glass window through which could be seen the glistening cars of the show-room.

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* Norval A. Hawkins & Company, with offices in New York, Chicago, Detroit and Toledo, made careful inspections of the branches for the Ford Company, reporting on accounts, [illegible]room inventory, condition of premises, and any other matters of interest. They insisted on [illegible] amusingly frank. For example, in refer- [illegible] a repair shop crowded with [illegible] were struck with the thought [illegible] ments would raise the conjecture in the minds of a prospective buyer that there is something wrong with the car . . . Towing cars through the streets in daylight is another matter that occurs to us as a very bad advertisement. Mr. Hays says he 'always does it after nightfall.'" Hawkins & Company report to Couzens, Ford Archives.

The floor of this large room, fifty feet deep, was of black and white marble; the cabinet work of golden oak; the railings of heavy brass. Four large tungsten prism globes gave light. Manager "Gus" Enders would himself explain the merits of the various types of car. On the second floor was the stock room, where customers could select their tires, polishes, lubricants, and other supplies. The inventory of parts here was kept at a value of $20,000; the classification was so good that any order for parts received up to five o'clock could be filled and shipped that same day. No Ford dealer or owner in southern Ohio needed to wait for a shipment from Detroit. The third floor housed the cars held for sale, sometimes as many as fifty. On the fourth floor was the repair shop, with lathes, drill-presses, and other machinery. The mechanics here, drawing on the stock of parts, could build a Model T complete within twenty-four hours.[45]

By March 1, 1913, the Ford Company had nearly seven thousand dealers. They were chosen with care: men financially reliable, of good standing in the community, occupying presentable homes. Travelling agents of the Ford Motor Company checked these representatives carefully, comparing them with those of other automobile companies in their respective areas. Preferably, the dealers handled Ford cars only. The company strictly supervised the appearance of the salesrooms, and it never permitted accessories to be sold in them. These travelling agents or road men demonstrated to country dealers the best methods of selling cars. By the end of 1912 the company's sales organization covered practically every town in the United States of 2000 or more. All dealers were required to carry a stock of the parts most frequently in request.

Year by year, it was the policy of the company to reduce the area allotted one dealer and increase the number of dealers. At regular intervals, the United States was analyzed by cities, counties, and townships. If it appeared that a country dealer was not making proper sales in some townships, the company reassigned these territories. If it appeared that a city representative was not reaching some districts, these were transferred to another retailer. Thus selling constantly became more intensive. Ford franchises for agencies were by this time regarded as highly valuable and were much sought after; and because of the heavy demand for the car, the company could obtain the best dealers in America and in foreign countries. All these men were given

the same discount. By the end of 1912, the company had more agents, more dealers, more salesmen employed by the agents, more representatives of the Ford Motor Company coming in contact with the public than any other automobile company or almost any other manufacturing company which might be named; it had probably more agencies than the rest of the automobile industry put together.*[46]

Cheapness, durability, simplicity, standardization of parts—these continued to be the main points of emphasis in the advertising used. Norval A. Hawkins, in managing the sales, liked to use the magnitude of operations as evidence both of the merits of the car and of the economies of quantity production. Thus he was quick to reprint in his advertisements such a news item as that from the Detroit *Journal* in the summer of 1909:

> What is proclaimed as the largest shipment of motor cars in one consignment in the history of the trade went forth from the Ford Motor Works early Friday afternoon. A Lake Shore train of 41 cars, each loaded with three motor cars, 123 motor cars in all, pulled away for Minneapolis soon after noon.
>
> The motor cars go to the Minneapolis selling agency [i.e., branch] for distribution throughout the northwestern territory supplied by the agency, and it is said that all the motor cars are already sold to the prosperous farmers and business and professional men of this northwestern section.[47]

As with other cars, victories in one or another of the countless contests in hill-climbing power, distance endurance, and speed held during these years were played up in advertising, sometimes *ad nauseam*. In these years half the cities of the land seemed to be staging automobile tournaments of some kind. Chicago had its annual Algonquin Hill climb, Washington its Sociability Runs, New Haven its Shingle Hill contests, and so on. Whenever steep grades, rough roads, mud, or water obstacles had to be encountered, the Ford did astonishingly well. The company liked to publish photographs of the indomitable little rattletrap climbing a high set of steps, chugging through a wheel-high creek, or perching itself atop some Western mountain. A Model T was the first car to climb Ben Nevis in Scot-

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* Dependable statistics on the automobile industry are not available for this period. Many companies made exaggerated claims. The Detroit *Journal* of July 20, 1910, states that the Everitt Metzger-Flanders Company expected that year to put out 16,000 E M F cars and 25,000 Flanders cars; the Ford [illegible] put out 22,000 cars; the Brush and Cadillac 10,000 each; and the Chalmers-Detroit 6350. The E-M-F figures were hopelessly Munchausenlike, the others are wildly inaccurate.

land.[48] Even in speed races on level courses the little car won its victories. It got a specially valuable amount of publicity out of the New York to Seattle race held in the summer of 1909.

This contest was arranged by the mining magnate Robert Guggenheim to help boom the Alaska-Yukon-Pacific Exposition in Seattle. Offering a prize for the best time over the 4100-mile route, he and the Automobile Club of America established a rigid set of conditions. The cars had to check in at thirty points; their engines were stamped; they could obtain new parts at only two places, Chicago and Cheyenne; they were forbidden to travel on railway tracks. It was a race to daunt the hardiest, for west of the Missouri much of the distance was practically roadless. Of two pilot cars sent to define the route, one travelling west broke down in Idaho, and the other struggling eastward from Seattle ran into seventeen feet of snow on the Snoqualmie Pass and had to be shipped over the ranges by rail. But on the afternoon of June 1, as President Taft officially opened the exposition, Mayor George B. McClellan of New York fired a gold-plated revolver, and six cars, two of them Fords, were off.

Both Fords rolled across the Mississippi at St. Louis two hours ahead of the nearest rival. Then rain set in. "For seven days," wrote Scott and C. J. Smith driving the leading Ford, "we wore hip boots and rubber coats while the cars labored through Kansas gumbo and Colorado and Wyoming mud and sand." Flailed by a hailstorm, torrent-bound by a Wyoming cloudburst, they toiled on. One night they went off a bridge in the darkness; when dawn came they got a section-crew to straighten their bent axle and rolled forward. In some mountain streams the car sank to its body in quicksand. Beyond Cheyenne they met grades reaching thirty-five per cent, and trails that did not allow six inches of margin from the precipice. Finally they struggled up to the much-feared Snoqualmie Pass. Stated C. J. Smith:

> The snow was about four feet deep. At that time of year there was ice on top of the snow. We rode along this pass until we got pretty nearly over it; then we broke through the snow. We could hear fellows pounding in the distance. They were on a railroad across there. We got the section gang and they helped shovel us out. It wasn't very far that we had to shovel. Mr. Ford met us part way . . . in the pass. After we went down and saw what they had to climb, we wondered how they got up there. We found out afterwards they got out and shoved the car all the way up. . . . When

Mr. Ford saw us coming through, he was tickled to death to see we were there first.[49]

Near Seattle, the ferryman on Lake Washington wished to hold the Ford until the other cars came up! The one foreign contestant, the Itala, had broken down and been withdrawn at Cheyenne. The Shawmut, a four-cylinder, forty-five-horsepower, 4500-pound car, was seventeen hours behind. The Acme, a six-cylinder, sixty-horsepower, 3600-pound car, was a full week or so behind. The other Ford finally came in after losing about a day and a half by trusting an ignorant pilot. Smith's winning car had covered the 4100 miles, crossing twelve states, in twenty-two days and fifty-five minutes, and still had New York air in its front tires.

While a duplicate Ford was placed on exhibition in the Seattle exposition, the winning car was driven down the Pacific Coast and then back east, dealers along the line making the most of its transit. Robert Guggenheim awarded the cup with a warm encomium: "Mr. Ford's theory that a light-weight car, highly powered for its weight, can go places where heavier cars cannot go, and can beat heavier cars, costing five and six times as much, on the steep hills or bad roads, has been proved. I believe Mr. Ford has the solution of the popular automobile." A booklet, "The Story of the Race," was distributed in tens of thousands to dealers. The company made the most of its victory in newspaper and magazine advertising. And the victorious car reached New York in time to be paraded in the Hudson-Fulton celebration, later going on display in Detroit.

Then came the cruel anticlimax. The judges discovered that Smith and Scott had violated the rules by changing the engine for part of the run; the award was revoked and went to the Shawmut car.[50] Nevertheless, the Ford had amply proved the possession of special virtues in this punishing contest. In the fall of 1909, moreover, a Ford car which was entered in the Munsey reliability run from Washington to Boston and return showed its prowess against about twenty competitors, including a Chalmers-Detroit, a Maxwell, a Hupmobile, a Reo, a Marmon, a Renault, a Columbia, and a Maryland. On five of the seven days of the race it rained. Of the larger cars five gave up completely, and three were penalized so heavily that they finished as non-contestants. The Ford took first place in its class, finishing with a better score than any car sold for less than $2500.[51]

6.

One striking new policy, born of the heavy sales, was determined upon by the directors in the summer of 1909. With business growing so rapidly, it had become preposterously wasteful to ship fully-built cars in quantity a thousand or two thousand miles. Better use of train space was imperative. The obvious solution of the problem was the establishment of branch assembly plants, to which cars could be shipped in knocked-down form, thus avoiding the possibility of railroad congestion as well as high freight charges. As a beginning, three and a half acres were bought in Kansas City, Missouri, adjacent to the Frisco and Missouri Pacific lines, and a $30,000 assembly building, designed by Albert Kahn, was thrown up.[52] The innovation proved a brilliant success. Freight was reclassified at lower rates; the necessity of using special freight cars was avoided—any box-car would do; the costs of handling were reduced; orders could be filled more promptly; and the planting of an important business in another city made friends for the company. Moreover, stocks of automobiles and automobile parts could be accumulated at the branch assembly-plant, permitting of production in Detroit during those seasons when trade had formerly been slow.[53]

Assembly branches, before many years passed, dotted the whole American map. Before the summer of 1912 opened, the company, pursuing its plan of expansion on the most generous scale, had bought assembly sites in St. Louis, Long Island City, Los Angeles, San Francisco, Portland, and Seattle. The land cost alone came to more than a half million dollars. Portland would perhaps have sufficed for Northwestern distribution, but the rivalry between that city and Seattle made it expedient to give the latter its own plant.[54] Couzens had made a careful tour of the West to explore sales possibilities and look at properties before the officers acted. In St. Louis the company started off with an especially loud bang. Its assembly plant, as erected during the summer and fall of 1912, while the three-cornered Taft-Roosevelt-Wilson campaign raged, was six stories high, with room for one hundred to two hundred mechanics to put together five thousand cars a year.[55] In 1913 the erection of a Southwestern assembly plant at Dallas began.[56]

From the Ford Motor Company, Ltd., in England was now born the first foreign assembly plant. At the beginning, cars had been sent to

London boxed complete; the axles, of course, resting on the floors of the boxes, the wheels placed loosely alongside. As demand grew, a better center of distribution was needed; and after thorough inquiry, Manchester was decided upon as being near the center of England and offering better freight rates and services than any other port. The eighty-mile Manchester-Liverpool ship canal had recently been opened. About the middle of 1911 the managing director of Ford, Ltd., Percival Perry, found at Trafford Park on the ship canal near the edge of the city just the building he wanted, an abandoned car factory. At this time the London tube system was being rapidly extended, and a plant had been erected in Trafford Park to make tube cars, but had failed for want of capital. Perry was able to buy the building and the long-term leasehold of its site for £2000. It met all his requirements for assembling operations. Moreover, the old coach-building works of Scott Brothers stood near by, fairly well equipped to supply bodies to Ford, Ltd.

Perry, cultivated, urbane, and energetic, showed at the new Trafford Park establishment the same organizing gifts that he had put into the mobilization of a marketing force in Great Britain. Engines and chassis came from Detroit. Bodies were at first bought from Scott Brothers; then, when this firm proved slow, their works were taken over, and Ford, Ltd., began making and upholstering all its own bodies for British and some for colonial use. By 1912 Trafford Park boasted a whole group of buildings—assembly plant, body works, repair shops, and administration and sales building. Sales rose steadily in Great Britain. In 1911 they amounted to 1485 cars, in 1912 climbed to 3081, and in 1913 reached a total of 6139. The Detroit management took great pride in all the assembling and manufacturing activities in Great Britain, as the most convincing evidence possible that American automobile design could successfully challenge British; and accounts of Perry's many-sided achievements figured largely in the *Ford Times*.

In one respect the capable English executive was in advance of his American superiors. The years 1911–12 found him giving careful attention to the condition of the workingmen at Trafford Park and worried about the low standard of living among employees who were paid only sixpence half-penny an hour. The results of his cogitations were soon to have an influence in Detroit.

Perhaps the most important single step in all the steady program

of expansion, however, was the acquisition in 1911 of the John R. Keim Mills in Buffalo; and of this we shall speak later.

7.

The great automobile boom that followed the panic of 1907 showed no diminution of force during the next five years. John T. McCutcheon published a cartoon in the Chicago *Tribune* (August 16, 1910) showing J. P. Morgan, August Belmont, James J. Hill, and other Wall Street figures making futile efforts to sell stocks and bonds at cut prices, while Automobile Row was crowded with farmers, clerks, businessmen, and doctors frantically bidding for cars. The demand for automobiles was so keen in 1909–10 that stocks of spare parts became depleted. Very few industries in the world in these years were paying such large profits as the motor-car industry. Demand continued heavily to outrun supply, particularly in medium-priced models. The four-cylinder twenty-horsepower Hupmobile at $750; the Sears-Roebuck Model L at $495 (for Sears, Roebuck made and sold cars from 1905 to 1910);[57] the Maxwell Runabout; the Overland, and a dozen others could not be made rapidly enough. Indeed, as in the early years of the bicycle industry, profits were often staggering. In the first half of 1909, for example, the new E-M-F Company returned profits of about $1,400,000 on an investment of one-seventh of that amount. No outsider knew how much the Packard Motor Company was earning, but the Detroit *Journal* was sure that it was making money in "fabulous" amounts.[58]

As for the Ford Motor Company, we have seen that its total cash dividends by July 22, 1909, slightly exceeded $1,700,000, together with a stock dividend of $1,900,000; while a week later it declared another dividend of $600,000. No wonder that sometime in these years Mrs. Ford, turning out her husband's pockets, found a check for $75,000 that he had entirely forgotten. That the demand for automobiles in general would continue to rise, that the high profits would attract more capital, that competition would grow sharper, and that price levels would then fall, was plain to shrewd observers. Within two years, predicted the Detroit *Journal* in the summer of 1909, the cost of cars might be cut in half, and the man with an income of $2500 could then afford to own one.[59] If the $2500-a-year man was ever to own a machine, it would have to cost not more than a fourth or fifth

THE STOCK MARKET VERSUS THE AUTOMOBILE MARKET

From the Chicago Tribune, *August 16, 1910.*

of that sum. The Model T touring car as first delivered in the fall of 1908 had cost $850, the roadster $825; in the fall of 1909 the prices went up to $950 and $900 respectively.[60] This upward movement ran counter to the demands of the time and to Henry Ford's wishes, and was soon to be sharply checked.

As the industry reached its new level of affluence, an exuberant expansion took place. When the year 1909 opened, Detroit had eleven

automobile companies, of which the Ford had the largest capitalization, two millions, and the Hupp Motor Car Company the smallest, $25,000. The best known of the other establishments were the Packard, the Cadillac, the Chalmers-Detroit, the E-M-F, and the Brush Runabout Company. The Cadillac was still in the hands of the Lelands, who prided themselves upon the success of the four-cylinder thirty-horsepower car they had brought out in 1905, and of which they eventually sold 67,000.[61] The Chalmers-Detroit, like the E-M-F, was a moderately expensive car. Others ran down to low levels; the Brush was selling by 1911 at $485, and was advertised as Everyman's Car, which would earn its keep for any farmer or businessman. The total capitalization of the eleven companies reached nearly $8,000,000, a sum which bore no relation to their real worth.[62]

The wave of enthusiasm for the automobile now brought a wild surge of new incorporations. Since Leland, Ford, Flanders, and the Dodges had all made fortunes, why should not other men do as well? During 1909 no fewer than twenty-two new companies were organized in Detroit. One, the Van Dyke Motor Car Company, planned a capitalization of one million, and three others, the Fairview Motor Company, the Owen Company, and the Metzger Company, proposed a capital of half a million each. Most of the newcomers, however, were satisfied to issue a hundred thousand in stock. Few indeed of these ventures were to make any impression on the American market. One of the exceptions to the rule of failure was the Hudson Motor Car Company, with Roy Chapin as its principal figure. Another was the Paige-Detroit, which later, when the three Graham brothers (young farmers from Indiana who had gone into truck manufacturing) obtained control of it, became the Graham-Paige Company.[63] The total capitalization of the twenty-two new concerns in Detroit was $4,310,000. Equally significant in the general expansion of the business was the tendency to bring the capitalization of the older companies up somewhere near their net worth. Packard, for example, suddenly lifted its capital from $600,000 to $10,000,000.

As the restless Roosevelt left the White House and the ponderous, cautious William Howard Taft took his place, American business in general felt a greater sense of security. Despite the government suits against the tobacco trust, the Standard Oil, and other huge combinations, the march of industrial concentration proceeded without interruption; the courts, it was hoped, would distinguish between good

combinations and bad combinations. Thus far automobile manufacture had been a highly individualistic process. Suddenly, now, as one more evidence of rising confidence in the future of the motor industry, General Motors, the product of William C. Durant's brilliant resourcefulness and abounding optimism, rose to public notice. A Bostonian by birth, Durant had been reared in Michigan under the eye of his grandfather, ex-Governor H. H. Crapo, had made a dazzling success in young manhood with a carriage company, and had then given the Buick line of automobiles a national fame. In 1908, according to Benjamin Briscoe, then a leader in the over-extended Maxwell-Briscoe Motor Company which made the car of that name,* Durant invited Briscoe to come to Flint, Michigan, "to see what the Buick Co. was doing." The latter agreed.

The two found much to discuss, and Briscoe, who had come to the conclusion that a combination with other companies was the sound move for his organization, suggested that he and Durant plan a large corporation which would include the Buick, the Maxwell-Briscoe, the Reo (R. E. Olds's car), and the Ford. Durant agreed; Briscoe approached Olds, Ford, and Couzens; and a meeting was held which promised a successful outcome. At a second, however, Couzens and Ford demanded at least $3,000,000 in cash. Olds promptly insisted on getting the same sum. Briscoe and Durant felt that they might have met the Ford demand, but $6,000,000 was too much for them to raise, talk was vain, and the entire project collapsed.

However, both Briscoe and Durant were still interested in a combination, and continued to confer. They evolved the International Motors Company, a paper project, but final arrangements fell through; and since the name had been suggested by a backer, Durant crossed out "International" and wrote "General" in its place. Briscoe now withdrew, but eventually organized the United States Motor Company, merging his own firm with the Columbia Motor Car Company of Hartford, which supplied $1,000,000 in cash. The firm went into a receivership in 1912.[64]

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* As organizer and promoter of the Briscoe Manufacturing Company, which made sheet metal goods and pressed steel parts, and became prosperous serving a number of automobile manufacturers, he became for a time the largest producer of motor car radiators in the world. Late in 1903 he organized the Maxwell-Briscoe Motor Company with Jonathan D. Maxwell, who it will be remembered had worked for Haynes and later for Olds. (Benjamin Briscoe, "The Inside Story of General Motors," *Detroit Saturday Night*, XV, No. 4, January 22, 1921, Section 2, 4, 7.)

The above is Briscoe's version; if it is true that he suggested the idea of combination to Durant, the latter had taken it up and handled it with greater audacity and imagination. Planning to operate on the Rockefeller method of paying for old companies mainly in stock of the new, in 1908 he succeeded in incorporating General Motors with a capitalization which was swiftly raised to twelve and a half millions.[65] His progress was daringly spectacular; clearly he meant to use the new company and its stock to add other large properties to his Buick holdings.

Once started, Durant moved with dazzling speed—for he had Napoleonic qualities. Within a year and a half, he had brought more than a score of companies, makers of cars or parts, into his combination. They included three major units in the field: the Cadillac, the Oldsmobile, and the Oakland companies. By 1910 Durant, with fourteen thousand employees, was producing one-fifth of all the automobiles made in America. In its first year General Motors had net sales of $29,000,000, and net profits exceeding $9,000,000.[66]

Inevitably, Durant made an approach to the Ford Company, as to all other large concerns in the field. The details of that encounter seem no longer recoverable. Probably the date was in the autumn of 1909. According to the unauthenticated story given by T. F. MacManus, a veteran Detroit journalist,[67] in his *Men, Money, and Motors,* the ebullient Durant heard a rumor that the company might be purchased, and sought out Couzens and Ford at the Belmont Hotel in New York. As Ford was lying on the floor in considerable pain from lumbago, Couzens went down to talk with the promoter in the lobby. He came back upstairs to Ford wide-eyed:

"Billy Durant wants to buy the Ford Motor Company."
"How much will he pay?"
"Eight million dollars."
"All right. But—*gold on the table!*" snapped Ford.
"How do you mean that?"
"I mean cash."

The story has a certain element of truth, as Durant himself has testified.* But neither Couzens nor Ford would have made so mo-

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* Durant (Conference with Joseph E. Davies, New York, November 22, 1926; Accession No. 96, Dodge Brothers, Couzens *et al.*, *vs.* Commissioner of Internal Revenue) testified on the matter at some length. His evidence runs: "Mr. Durant stated that in 1910 Mr. Ford and Mr.

was maritime law, in which he became an authority, often serving as a proctor in important cases. In 1906 Theodore Roosevelt appointed him Judge for the Circuit Court of the Southern District of New York.[5] Although his health was poor, he was a hard worker. At times he seemed cranky; though it would be fairer to say that he was impatient of technicalities, liked to cut through them to the heart of a question, and then confidently took his way to a decision.

As Parker stated, the judge was unversed in patent law. This was not to his discredit, nor was such ignorance uncommon, for judges were assigned to cases regardless of prior experience. Hough was also ignorant of automotive history, mechanical theory, and technological terms. Recognizing his limitations, he tried to overcome them. He announced immediately that he would read the entire record. When Samuel R. Betts, the first lawyer to address him, took up Claim 1 of the patent and referred to the engine, Hough cut in with frank modesty: "Someone will have to explain to me what the liquid hydrocarbon gas-engine is."[6] For some time he felt his way, asking questions and absorbing information. Attorneys for the complainants, presenting their arguments first, were skilful in instructing Hough and at the same time establishing their own case. When Parker and Murray, counsel for Ford and Panhard respectively, spoke later, they were obliged to break the pattern that Betts and Redding had established. This involved at certain points a rather intricate reasoning, particularly with respect to the prior art, the character of Selden's first claims, and the fundamental changes in his claims which they accused him of making during the period from 1879 to 1895.

Hough tried to be fair, but the record reveals his impatience of deta and his strong desire to simplify the case. At one point he showe great annoyance with attempts to distinguish between different typ of "liquid hydrocarbon engines of the compression type," wheth Brayton, Otto, or Ford. Again, he remarked with pleasant sharpne "I only wish to produce a meshing of arguments. It sometimes seem to me that each of you gentlemen has an argument machine that going around merrily, but they are not meeting each other."[7] It significant that Hough interrupted Parker much more frequently th any other speaker, and while Parker always tried to make his positi clear, his close argument tended to exasperate the judge.

On the afternoon of Tuesday, June 1, the New York-Seattle lo

A group of Ford personnel at the Detroit Boat Club, September 17, 1908

Beginning at top, left: figure at the side by potted plant, unknown, John Dodge, John Anderson, Horace Dodge, Frank Kulick, David Gray, C Harold Wills Second row: James Couzens, Gordon McGregor, F R Fox, Stan Roberts, Norval Hawkins, Henry Ford Third row R M Lockwood, M [redacted] Coate, H B White, W. C Anderson, Charles T Hendy, Jr, H [redacted] Harper (?) Fourth row R. P Rice, Thomas J Hay, E R Stearns, H J Cunningham Front row L C Block, Gaston Plantiff, C [redacted] Fay, C C Meade

was maritime law, in which he became an authority, often serving as a proctor in important cases. In 1906 Theodore Roosevelt appointed him Judge for the Circuit Court of the Southern District of New York.[5] Although his health was poor, he was a hard worker. At times he seemed cranky; though it would be fairer to say that he was impatient of technicalities, liked to cut through them to the heart of a question, and then confidently took his way to a decision.

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Leading employees of the Ford Motor Company, 1908 or 1909

Front row, starting second from left. C. Harold Wills, John Dodge, Henry Ford, James Couzens, John W. Anderson, Horace Dodge and Horace Rackham Second row, starting second from left: T Walborn, H Limbach, W. Flanders and G Plantiff Third row, second from left N. Hawkins, behind Ford and Flanders, Gordon McGregor fourth from right: Klingensmith Last row, second from right: Pelletier

Two Danes who left their impress upon automotive production—William S Knudsen (from a group picture taken in 1913) and Charles E. Sorensen (as he appeared in 1918)

distance race started from City Hall Park, and preparations for the event were visible from the courtroom. Henry Ford went down to wish success to the crews of the two Ford cars. Telling reporters that his entries would arrive first and second at Seattle, Ford expressed regret that only four other manufacturers had entered machines. Apparently he returned to the hearing before Mayor George B. McClellan, Jr., fired the starting shot.[8]

As the attorneys and judge came to the windows to watch, waiting for the gun, Frederic R. Coudert, representing the Panhard group and the youngest and most outspoken of the counsel—he was then thirty-eight—remarked with feigned surprise: "Your Honor, there is something that puzzles me. I don't see a Selden car. I see a Ford car, two Ford cars, but I see no Selden car!" Hough and the others laughed.[9]

On another occasion, presumably at this hearing, Coudert was impressed by Henry Ford's social view of the automobile. He had been driven from his home in Oyster Bay by André Massénat, a client, in a big European car. The machine cut a swathe through the Long Island traffic, scattering chickens and livestock and frightening horses, cyclists, and people afoot. Coudert heaved a sigh of relief when Massénat parked near the judicial chambers. The young lawyer came into the courtroom and found himself sitting beside Henry Ford.

"Mr. Ford," he remarked as he wiped his brow, "I came in from Oyster Bay by car. We didn't kill anyone, but everybody on the road hated us, and it was probably sheer luck that we didn't have a collision. I think you are creating a social problem with your car."

Ford replied calmly, "No, my friend, you're mistaken. I'm not creating a social problem at all. I am going to democratize the automobile. When I'm through everybody will be able to afford one, and about everyone will have one. The horse will have disappeared from our highways, the automobile will be taken for granted, and there won't be any problem."

"And by God," exclaimed Coudert in recalling the incident, "he was right."[10]

2.

After the hearing Judge Hough took the armfuls of testimony in the record to his summer home in Rhode Island and addressed himself to the task of digesting it and formulating his decision. It was a fear-

ful labor. The Ford and Panhard testimony contained an enormous amount of repetitious material. The process of taking evidence before notaries and examiners had made for further prolixity and confusion. Hough was irritated, and in pronouncing his opinion he characterized this process with pungent sharpness.

It is probable that the mass and confusion of the evidence worked for the complainants. They had presented the simplest briefs, elaborately indexed. They pounded away at the points in their own favor. Selden, they insisted, was a great pioneer; he had designed an operable engine and carriage, the first for which a patent had been sought and granted, the first using a "liquid hydrocarbon engine of the compression type." Their method is well illustrated by the comment on the practicality of the carriage:

> We have already pointed out in connection with the early work done by Mr. Selden that before the Selden application was filed the patentee *commenced the construction of the vehicle patented, and completed the same,* so far as the engine was concerned, so that it could be operated and tested. . . . The inventor did not file his application without having assured himself that the device was operative. He first determined the amount of tractive effort necessary to propel a road carriage; invented a rubber tire and traction device to insure the desired traction; designed, built and operated the engine for propelling the vehicle, and determined that it could be built so as to combine the two requisites, power and light weight, and then filed his application. (Italics mine.) [11]

Betts and Redding linked this statement with the performance of Exhibit 157. It was a decided gilding of Selden's accomplishments, which had amounted only to an irregular operation, apparently never more than five minutes in duration, with one cylinder of the three-cylinder motor. Exhibit 157, constructed twenty-five years after the patent was filed for, leaned much, as Parker showed, on more modern facilities, methods, and parts than Selden had available in 1879.

However, the presentation had effectiveness despite its effrontery, and Betts and Redding clung to it, citing Dugald Clerk while they brushed aside as frivolous Lenoir's carriage of 1862 (they had prevented French testimony being taken upon it on the ground that they had never disputed its operability, yet later flatly questioned whether it had ever run), Rosenwald's French patent, Brayton's boats, street

car, and omnibus, and all other evidence upon prior art. Similarly, they denied that Selden had unfairly altered his application to cover automotive developments in the 1880's and early 1890's. Nor, they argued, were Parker and Murray entitled to question the Selden claims! "The contract is between the Government and the inventor, and the defendant infringers are not the proper interpreters or entitled to the benefits of interpretation."[12]

It was a smooth, forceful, and simple presentation, calculated to attract Hough amid the confusion of much of the material.

In contrast, Parker made a clumsy psychological approach to the court. His written brief was forbidding in size. In its earlier sections he dwelt on the evasive and obstructive tactics of the opposing counsel, the delays for which their witnesses were responsible, the contradictory character of Clerk's, Bentley's, and Gibson's testimony, the suppression of the Winton evidence, and the attempts of Selden and the A. L. A. M. to validate the patent on the basis of a succession of settlements. While all this was well documented and germane, Hough, impatient to get to the heart of the problem, may have regarded the detailed opening as hair-splitting and obfuscative. He may never have read beyond it with the concentration which the presentation deserved.

Parker followed this opening with an exhaustive discussion of the prior art, unfortunately beginning with steam carriages, which Hough at the oral hearings had brushed aside as irrelevant. (The brief had of course been put in before the arguments, and Parker could not have altered this feature had he wished.) In his account of gasoline vehicles Parker demonstrated that beginning in 1860 hydrocarbon engines capable of propelling road carriages had existed. He showed that Savalle (1867, and 1869) and Rosenwald (1877) had patented combinations like Selden's using such engines; he proved that Hilton's and Johnson's provisional English patents presented a similar combination, naming gas and petroleum engines as possible power plants. He demonstrated that Brayton had utilized his engine to drive streetcars, boats, and an omnibus some years before Selden first filed his application.

Parker brought out fully the damaging admissions made by Clerk and Bentley. (Betts and Redding simply ignored such admissions, which went far to destroy the testimony of their experts. For example, Clerk in denying the utility of Lenoir's engine, conceded that had a non-compression motor been effective in propelling a vehicle, Selden's

claim might have been in question. This was only an honest concession, for if a hydrocarbon engine of *non-compression* type had shown its capacity to drive a car, then the great novelty Selden claimed for his compression-type motor would no longer exist. Indeed, Lenoir would be in the position of having done the pioneer work in relating a hydrocarbon engine to a vehicle.) Parker was able to point to the Ford-Lenoir car as evidence that a non-compression engine was effective. All these considerations, with the uses of Brayton's motor, supported his contention that if Selden had anything it was a combination with the particular engine shown in his application, and nothing more.

But such close-knit, abundantly documented reasoning was repugnant to Hough's desire for simplification. So perhaps was Parker's precise tracing of Selden's application through its almost seventeen years of life. As for his cogent arguments on patentability, which, supported by numerous citations, damned Selden's claims legally from several angles, Hough probably lacked background or patience to follow them.

Parker's brief was the heart of the defense case. Compared with his opponents' it was chess to checkers. Its exhaustive and meticulous structure is tremendously impressive, but it was poorly presented psychologically, and to the wrong judge. Had Parker plunged at once into his argument on the fundamental character of Selden's combination and quickly made the strong point that it was either a combination with an old motor, and hence non-patentable, or one with a particular motor, and hence applicable to that only, he might have been far more effective.

3.

Judge Hough was ready with his opinion on September 15, 1909 Determined to find a simple solution, he had evolved a statement which, once several highly dubious assumptions were accepted, marched convincingly to the decision he was to make.[18]

Hough pointed out at the beginning that counsel for both sides agreed that Selden's claims were for a combination: "there is no denial that in form nothing but combinations are claimed." He emphasized the fact that no mechanical *device* had been patented—all the devices involved were old in the prior art. Selden claimed simply

to have proposed a combination which resulted "in a harmonious whole capable of results never before achieved, and of an importance best measured by the asserted fact, that after 30 years no gasoline motor car has been produced that does not depend for success on a selection and organization of parts identical with or equivalent to that made by him in 1879." The defendants, Hough held, denied that Selden had done what he now asserted; they also denied that their combinations were like Selden's, "being neither identical nor equivalent."

A presumption existed in favor of the complainants, said the judge, in that they had a patent, and this had received a certain further support when Judge Coxe had overruled the demurrer in the Winton case.

Hough now came to the state of the prior art in 1879. The defendants, he held, had laid undue emphasis on this, particularly on steam transport. He swept aside what seemed to him to be small points —Lenoir's alleged motor carriage, Savalle's and Rosenwald's patents. A larger view was proper, and what did it show as to the "horseless carriage" industry when Selden first filed? "There was no such industry, the art existed only in talk and hope, no vehicle even faintly fulfilling the requirements above outlined had ever been built, and there is no competent and persuasive evidence that any experiment had ever moved 100 feet, or revealed an organization warranting the expectation that it ever would do so."

This sweeping statement was worse than dubious. Lenoir's and Brayton's performances both challenged it; had Parker been permitted to take the evidence about Marcus which he knew was available, and submit it in support of his contentions, he could have proved Hough's pronouncement downright silly.* Although the Ford-Lenoir car had proved the utility of the non-compression motor, Hough dismissed

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* *On June 28, 1905 John P. M*[illegible] had asked per-
mission to take testimony in Fran[illegible]
and that of Siegfried Marcus's in [illegible]
He named his proposed witnesses. [illegible]

[illegible] in it. The complainants
[illegible] it they had never denied
[illegible] posed testimony "super-
[illegible] Europe" was not admis-
[illegible] he record, but seems to
[illegible] complainants' position.
[illegible] the grounds that they
[illegible] deride it and to claim

this in a scornful footnote: "Mr. Clerk did intimate that he doubted whether any vehicle with a non-compression engine could move at all. [It was not the expression of a doubt, but a downright assertion, with the gravest attendant sequiturs.] Mr. Ford had shown that he was mistaken. By making the engine four times the size of Ford's compression type, there is obtained about one-seventh [actually about one-sixth] of the power. It hardly seems that the pleasure of contradicting Clerk was worth so much trouble." (The obvious answer was that the engine operated effectively, and produced more usable and dependable power than Selden's.)

Just as he brushed aside prior performance—the more astonishingly in that Selden until 1905 had no performance himself—so Hough waved aside prior patents. They lacked, he asserted, the engine (and it was true that the drawings for engines were usually not so detailed as Selden's and none existed for a compression type.) Naming the principal engines known in 1879—the Brayton, the Otto & Langen, and the 4-cycle Otto—he held that all were of a kind. No fundamental difference, he wrote, appeared between the two-cycle, external compression Selden motor and the four-cycle, internal compression Otto. Their contrasting characteristics were no more generic "than are variations in rapidity of breath in different men, or in the same man at different times."

Finally, Hough concluded: "Success is never anticipated by any number of failures, and when it is clearly kept in mind that what Selden claims is a combination, and not any one of its elements, the defendants' references to prior patents and publications may thus be finally disposed of so far as this court is concerned."

Having thus thrown all previous accomplishments and patents out of court, and pronounced Selden's engine a covering unit for any gasoline engine, Hough considered the patentee as an inventor and pronounced him successful as to his engine—lighter and more compact than any preceding it. Was the carriage he outlined a successful accomplishment? Selden, Hough held, "organized a new road vehicle," and "used an arrangement of Brayton's engine never before attempted, made or patented." It was futile to consider the differences between the Brayton and Otto types—indeed, from Lenoir down all "gas engines" were basically the same. There was room for a pioneer patent using one of the type in a combination. "Selden's is such a

patent;" having taken it out, he had a right to "a broad range of equivalents;" and thus all other engines of the liquid hydrocarbon compression type were covered by the patent!

He agreed that "Selden has contributed little to motor car advancement in the United States, and nothing at all abroad." The patent was a great idea, conceived in 1879, which lay concealed in a file wrapper until 1895. "But the patent speaks from the date of issue, and unless Selden did something unlawful during his sixteen years' wrangle with Examiners . . . he is within the law and his rights are the same as those of the promptest applicant." Selden, Hough held, had not violated the law. His exhibits 89 and 157 could be held to have proved operability. The latter "is a wretchedly poor car for 1905, there were probably as good if not better cars in 1895, but it is a marvel of invention for 1879,—and that is more than enough for the purposes of these cases." It was, he conceded, unusual for an idea to have lain dormant "until the world caught up to and passed it," and then to have been "embodied in a patent only useful for tribute. But patents are granted for inventions, the inventor may use his discovery, or he may not, but no one else can use it for seventeen years."

That was the decision. Hough had simplified the issues resolutely, in the process accepting the complainants' case almost in its entirety. Now every automobile manufacturer in the United States, all foreign manufacturers importing cars, and all individuals using unlicensed cars were infringers upon Selden's rights, and subject to the consequent penalties.

4.

Everywhere jubilation possessed the Selden camps—in Rochester, in New York, in Hartford. Hiram Percy Maxim recalled how "the exuberant Mr. Cuntz burst into my office . . . with the news."[14] Among individual members of the Association of Licensed Automobile Manufacturers the rejoicing was less notable. After all, they were paying tribute, and at heart many would have been delighted to see the patent damned. They had half expected it to be. "By what miracle that flimsy patent was ever sustained in the lower court I know not," said F. L. Smith eighteen years later.[15]

Nevertheless, they rallied to give vocal support to what was after all their cause. Winton announced that "nothing now remains but to

exact from all trespassers a share of that income they have enjoyed for years without letters patent." E. R. Thomas and H. H. Franklin, of the companies bearing their names, issued more temperate statements, while Hayden Eames, once an official of E. V. C. but now manager of the Studebaker firm, called upon the A. L. A. M. to show "broad-minded liberality." The implication seemed to be that if Ford would now surrender, all might yet be for the best.[16]

But Ford was not in a yielding mood. "Selden suit decision has no effect on Ford policy—we will fight to a finish," he had telegraphed to the Gibson Auto Company of Indianapolis the day after the decision.[17] A fierce resolution persisted in the anti-Selden ranks. "The automobile trade in Detroit," reported that city's *Journal*, "say that it is not believed that the Selden patents [sic] will be upheld in the higher courts, and that some of the best patent lawyers in the country have given opinions against them."[18] Ford himself amplified his initial statement by declaring that the case would be pushed until the $6,000,000 of Ford assets and the $6,000,000 of its bonding company were both wiped out. "There will be no let-up in the legal fight, and I expect that ultimately the supreme court of the United States will hold that the Selden basic patent is not valid."[19]

For him, and perhaps also for Couzens,*[20] this was the only thinkable course. Ford seems never to have wavered for a second. Yet consternation seized some of his associates. "It seemed like the end," W. J. Cameron said years later, summarizing what he had been told by men then active in the company.[21] John W. Anderson remembered the time as one of crisis. "We thought we were in great jeopardy. We were feeling very blue indeed." But he added, "We resolved to die hard." Later that fall F. L. Smith apparently made overtures to the Company, and Anderson wrote a letter declining "to entertain their suggestion as to a settlement."[22] The A. L. A. M., said Anderson, sent representatives to New York in January, 1910, and tried to intimidate dealers and manufacturers preparing for the independent Show.

The Ford group prepared to hire the best counsel they could find in

* Mr. Ralzemond D. Parker, son of the chief Ford attorney, wrote the author on April 12, 1953, with respect to Couzens and his attitude during the eight-year-long litigation. Mr. Parke
had characterized Henry Ford
ster him about expens
mplaints about cars and
the Association. I think
nt. He was a clerk."

New York to carry on the case. A letter of Parker to Henry Ford late in October shows that he was making arrangements to this end, probably having agreed that an easterner and a less intense advocate might handle the appeal better than he. He suggested retaining Edmund Wetmore of the firm of Wetmore, Gifford & Crisp. Crisp had of course already assisted with the defense, but Parker had misgivings about him. "I don't think Mr. C. is quite the man for that under the circumstances [that is, for the moves in court leading to an appeal] and I don't pretend to be."[23] Wetmore and his partner Livingston Gifford became the chief attorneys, Crisp and Parker still working with them. Since Parker was now in his sixty-eighth year, had labored prodigiously, and had been shaken by the death of a daughter, perhaps his physical condition was a factor in his relinquishment of the outstanding role in court. However, there is evidence that he continued to give chief direction to the defense case; this is also the impression his son and daughter had. His original brief remained, and he submitted a new one of 31 pages. Both provided ammunition for his new colleagues, and a more searching eye than Hough's might yet appraise them at their true value.[24]

But if the Ford Motor Company was thus resolved to press forward to victory, not all its associates showed equal spirit. Coudert, acting for the French firms, was shocked to learn of a possible defection when his clients wrote that they wanted to withdraw. The suit had been long and expensive; their adversaries had won a victory; they preferred to take out a license and end the struggle. Coudert was about to sail for Europe. He cabled: "Wait until I come over." In Paris, gathering the Neubauer and Panhard officials together, he urged them not to quit. Speaking in his fluent French, he told them that he could reverse the decision. It would mean prestige, and perhaps would save them money. They listened, but the young American could see that they were not convinced. He produced his trump card. "Gentlemen," he declared, "I have said we can win; I will now prove to you how much I believe it. If you will join in the appeal, which will involve your paying the costs of printing the record—I cannot legally do that myself—I will charge you nothing for my services if I lose." This confident offer won his clients over. Their continuance in the fight was an important service to the Ford Motor Company as well as a satisfaction to Coudert.[25]

One calamity was thus averted; another was soon in prospect. The A. L. A. M. had no intention of leaving the situation in the industry as it had stood after the decision. They had won a victory; to use it vigorously was only logic. They turned to the attack.

The most vulnerable sector in the Ford lines was that held by his many moral allies, the independent manufacturers. For the most part these were members of the American Motor Car Manufacturers Association. The A. L. A. M. in January, 1910, was to detach from the A. M. C. M. A. Alfred Reeves, installing him as their general manager in the place once held by George H. Day. Reeves would have been helpful in capturing some of the independents, who after Hough's decision might now be susceptible to Seldenite persuasion, but most of them had been brought over before he took office.

As early as October 10, 1909, the Detroit *News-Tribune* reported that at least eight A. M. C. M. A. members had decided to accept licenses. Their decision followed a meeting of some independents in Buffalo, at which "a representative of the A. L. A. M." was "more or less present." This shadowy individual had a number of good talking points. The prospects of final victory for the Selden group, the reduced fee for licensed manufacturers, the hope of restricted competition, all were effective considerations. Probably a delicate hint was also dropped that those who rejected an offer now might not have another opportunity. Finally it was pointed out that the A. L. A. M. was already planning suits against additional infringing firms—indeed, some had already been brought.

The defection, which seems to have taken place about mid-October, included the Maxwell-Briscoe, the Premier, the Mitchell, the Reo, and the Dayton Companies, the most vigorous of Ford's former allies. Their surrender must have been a hard blow to him and his associates.

It was followed almost immediately by one even more sensational, if not more injurious. William C. Durant's rapidly growing giant, General Motors, which the winter before had comprised only Buick and Oldsmobile, had for a time fallen out with the A. L. A. M. The Olds license had been cancelled for non-payment of dues and although Buick had remained a nominal member, Durant in May, 1909, had expressed a wish to wash his hands of the Association.[26] However, he had meanwhile acquired Cadillac, Rainier, Oakland, Welch, Reliance, and Rapid, and the possibilities opened by Hough's decision had

apparently convinced him that safety lay in getting all his cars into the fold again. On October 19 it was announced that he had paid $1,000,000 back royalties—probably an exaggeration—and that all his plants were licensed. "A part of this immense sum, it is understood," reported the Detroit *News*, "will return to General Motors in the form of dividends paid by the A. L. A. M. to licensed members of the corporation." While some A. M. C. M. A. members characterized the arrangement as a token of lack of confidence on the part of the A. L. A. M., it undoubtedly strengthened that unit immensely.[27]

The suits that had been a factor in bringing both the eight independents and General Motors to terms had been filed in September. Fifteen were brought against various importers of foreign cars, and one against the Fiat Automobile Company of Poughkeepsie, which manufactured the American Fiat. The foreign firms sued were German (Benz, Daimler, Zust, Otto), French (Mercedes, Renault, Ducasse, Delahaye), Italian (Isotta, Italia), and English (English Daimler and others).[28]

Although after this volley the A. L. A. M. started no further suits, its very inaction had a sinister quality, and rumors of new attacks persisted. In January a reporter for the Detroit *Journal*, pursuing these menacing stories, called on "the Detroit patent attorney of the Association of Licensed Automobile Manufacturers," and came away with an official statement that more suits would soon be brought—against manufacturers, against dealers, "and, if necessary, against the users of infringing autos."[29] The trend of feeling and action among independents grew unmistakable—they were seeking licenses. It was about this time that Reeves came over to the A. L. A. M., and the process of disintegration among the independents became a precipitate one. On February 8 the *News* reported that "the recent court decision in New York so depleted the ranks of the A. M. C. M. A., or unlicensed association, [that] that body is expected soon to go out of existence."

It did so—on the following day, the fifth anniversary of its founding. "Of the 43 members 30 are now in the licensed fold," the *News* reported on the 9th. A surplus of $60,000 was divided among the 43, apparently regardless of defections. Ironically, a few days later the defunct association's handbook "Leading American Cars," appeared, containing member names, addresses, and descriptions of a wide variety of automobiles.[30]

Thus the independents, who for five years had cheered Ford on and had presented a visible opposition to the "trust," collapsed as an organized body. Ford was left with a mere handful of supporters, like a lone but defiant machine-gunner on a contested ridge, most of whose companions had fled or been captured by the enemy.

5.

He watched these developments with a grim concern and a seething resentment. His sense of outrage at his enemies' tactics only sharpened his will to resist. For many, his figure took on more than ever a heroic quality. On March 1 the Detroit *Free Press* printed an editorial titled: "Ford, the Fighter." "Ford the fighter, salute!" ran the opening sentence. The Detroiter, continued the writer, would not quit. He had spent $200,000, and was "equal to his weight in wildcats. . . . Of the cause behind him, the lawyers are more able to talk, but as a human figure he presents a spectacle to win the applause of all men with red blood; for this world dearly loves the fighting man, and needs him, too, if we are to go forward."

This salute was reprinted in the *Ford Times*, which was busy inspiriting the Company's widespread organization and holding it intact. Earlier the house organ had printed a letter from Newton H. Davis, a dealer in La Rue, Ohio, to the general sales manager of the Jackson company, which had now joined the A. L. A. M. Davis, primarily a Ford dealer, had also handled the Jackson; recently he had received several form letters from that company urging him to follow it. He replied with pungent scorn:

> It is clear to me now that your company has shown the white feather, and it is the policy of the A. L. A. M. to shut out competition, and especially to force the Ford Motor Company out of business.
>
> I am sorry to see things as they are or as the A. L. A. M. thinks they will be, but . . . I humbly beg to advise you that there is one small dealer in central Ohio that is going to continue to travel the bridge that has safely carried him over.
>
> When I signed up with the Ford Motor Co. they had no objections to me handling your line, and now that you have joined the "Trust" you seem to be after a company that never in any way laid a straw in your path, but continued the policy of building light cars to meet the wants of thousands of people that could not afford a car such as the A. L. A. M. would design.

> I am not much alarmed about the finish. I am of the "opinion" that Ford will be building cars when the "Trust" will be out of business, but "IF IT WORKS OUT THE WAY IT IS FIGURED," I go out with them.[31]

This response was apparently fairly representative of Ford dealers. A number of independent manufacturers were also staunch in their opposition to the A. L. A. M. Ford would be glad of such companions as they appeared, although he would unquestionably have pursued his course even if left quite alone.

The Selden forces now moved forward to a renewed attack. They were preparing to seek a court decree which would force the Ford company to pay for infringement (a move the Ford lawyers would counter with a proposal to put up a bond pending appeal, a course approved by Hough in August),[32] but meanwhile the licensed group wanted to present to the court as near a *fait accompli* as possible—that is, to bring in more manufacturers, to sway public opinion, and to show diligence in enforcing the patent.

By February 8 its representatives in Detroit were awaiting the arrival of Reeves, who as A. L. A. M. manager had charge of public relations. Appearing some days later, he tactfully declared that "the keynote of its [the A. L. A. M.'s] policy is the protection of the automobile industry." Men were starting factories on "blueprints and nerve," they were irresponsible, and they were injuring not only the industry but the public, who bought cars to find the makers either unable to service them properly, or going out of business. The stable producers had a position to defend. "The pioneers in the industry have a right to protect themselves against what may be termed 'wildcat' companies which are springing up like mushrooms."

Reeves paid a courteous compliment to Henry Ford. The Association respected him. "There will be no cut-throat methods employed toward him. He is recognized as one of the pioneers and the association only desires that he enter the A. L. A. M. The matter between Ford and ourselves is being fought out in the courts." The principal A. L. A. M. activity, Reeves said, would be advertising—to educate the public. But, he added: "Later we may find it necessary to start new cases against persistent manufacturers."[33]

The attack opened on a nationwide scale in February, 1910. With a half-page advertisement showing a picture of the official license plate,

the A. L. A. M. appealed directly to the public. The Selden patent, ran the copy, had been held valid by Judge Hough. It was basic, thus forbidding the manufacture, sale, or use of any unlicensed automobile. "It is clearly the duty of every law-abiding American citizen to respect the exclusive rights secured by the patent . . . as it secures to the owners and licensees under its exclusive rights authorized by the Constitution of the United States." The A. L. A. M. members had been "chiefly responsible for the development of the automobile to its present perfected state. *There is no reason why any one who is buying a car should not buy a car licensed under the Selden Patent. The licensees build cars of all classes and for all prices.*" The advertisement was printed "so that buyers of automobiles may know the facts and be governed accordingly." A list of members followed—seventy manufacturers and two importers. Of these, at least twenty-one had recently been Ford's fellow members in the A. M. C. M. A.[34]

As in 1903, the Ford Motor Company leapt forward to match message for message and space for space with their opponents. In an advertisement of the same size facing the A. L. A. M.'s the Ford copy announced:

"*This* Advertisement *Is* Published for the *Protection* of *Automobile Buyers* by the Ford Motor Company, Detroit, U. S. A."

Reminding the public of the A. L. A. M.'s campaign in 1903, it declared that there were *many reasons* "for NOT buying a car licensed under the Selden Patent." Each car so licensed encouraged "trust methods," curtailed the evolution of the industry, and promoted the distribution of "high-priced and poor quality cars." Henry Ford had done more to advance the industry than "any dozen other manufacturers in the business." The patent? It was "a freak among alleged inventions and is worthless as a patent and worthless as a device." There was no judicial decree entered against the sale of Fords, and "the Lower Court Decision . . . is only the first round of a patent battle. There remain the Court of Appeals and then the Supreme Court, to both of which we can, and, if necessary, will, carry the case." A bond was promised to any purchaser who wanted it, backed by the $12,000,000 assets of the Ford Motor Company. The advertisement added: "N. B.—This fight is not being waged by the Ford Motor Company without the advice and counsel of the ablest patent attorneys of the East and West."

The fight flared into further advertisement and into hard-hitting statements by both sides. The A. L. A. M. sought to prove that it was no monopoly, but a cooperative organization designed to protect the industry and the public. The *Ford Times* jeered at the Association's "educative campaigns." "Mr. Ford isn't wasting much time on educational campaigns." It pointed out that when Ford asked for bids from bonding companies to supply bonds, "several of the largest . . . were anxious to get and bid for the business."[35] The "trust" responded: "No bond is required when you buy a *Licensed Motor Car.*"[36] Charges and countercharges were exchanged. The "72 varieties," as Ford had called the Association members, increased to 75, then to 80, and finally to 84.[37] Occasionally a voice from the public was heard, like that of W. H. Schilder, former owner of the Chillicothe (Ohio) Automobile Company, who sent an open letter to Alfred Reeves. His communication was gleefully printed by the *Ford Times* under the heading:

> *This is certainly A LAM*
>
> The writer [said Schilder] is no longer engaged in the sale of automobiles, but soon hopes to be the fortunate owner of a Ford (which I believe you call unlicensed), in my opinion the best automobile in America for all kinds of service, regardless of price. It seems to me that some of you licensed (or trust) manufacturers must be of the same opinion, or else you would not have the "Gall" to put in circulation some of the literature with which you are trying to "bluff" the buying public.
>
> When I purchase my Ford car, I don't want Mr. Ford or anyone else to give me an indemnifying bond to operate the same, as I feel that the Supreme Court of the United States will quickly see the injustice of your claim, and award to Mr. Ford such a verdict as will forever close the mouths of a lot of jealous minded manufacturers who are unable to compete with him in both price and quality.[38]

On or about May 16 suits were filed against twelve manufacturers; two at least, the Warren of Detroit and the Imperial of Jackson, Michigan, were former A. M. C. M. A. members who had resisted pressure. The Abbott Motor Company of Detroit, another unit attacked, had denounced the patent, promising to defend itself "with the best legal talent." The Warren Motor Car Company soon joined the advertising battle, announcing: "We are not paying tribute for universal ideas abridged to anybody's obsolete methods of motor car construction."[39]

Another A. L. A. M. target, the Carhartt Automobile Corporation of Detroit, filed an answer asserting that it had "been promised by an agent of the corporation controlling the Selden patent" that it would get a license, went to great expense as a result of its expectations, never got one, and was now sued![40]

The Velie Motor Company of Moline, Illinois, turned the tables on the Association by bringing a suit for $500,000 damages, alleging that through misrepresentations of the Selden group its business had been injured to that extent. It had been asked to pay a $14,000 initiation fee, and to agree to restrict its 1910 production to 2500 cars, and that for 1911 to 2000. The Velie named fifty-four companies, A. L. A. M. members, as defendants.[41]

Among the pyrotechnic displays in the campaign were advertisements of the Selden Motor Vehicle Company, which after the Hough decision blossomed out with five models, "Made by the Father of them ALL"! Selden as previously noted was a licensee. The phrase he now used to describe himself seems to have been adapted from that popularly applied to Gottlieb Daimler, "Father of the Automobile."[42] To most manufacturers and dealers Selden was already what he would soon become for posterity—merely the father of the greatest of automotive controversies.

6.

On November 22, 1910, more than forty attorneys[43] gathered in the old Post Office Building in New York to present their written briefs and oral arguments for the appeal. Three judges were sitting in the case: Henry Galbraith Ward, Emile Henry Lacombe, and Walter Chadwick Noyes.

Ward had been a former partner of Hough in Robinson, Biddle & Ward. He too had been an expert in maritime law. But at fifty-nine he was somewhat older than his former partner, he had served on a higher court, and he had the reputation of being unusually understanding and tolerant.[44] Judge Lacombe was sixty-four, and the presiding justice of the Appeals Circuit. A Columbia University graduate, he had served an apprenticeship as corporation counsel before being appointed by Grover Cleveland to the Circuit Court, Second District, in 1887, taking his place on the Appellate bench when this was established in 1891. He undoubtedly had some familiarity with patent law,

and probably had examined the record of the Winton case when he presided over its settlement in 1901.[45]

However, Noyes, at forty-five the junior, was to take leadership among the three. A Connecticut Yankee by birth, of old New England descent, he had attended Cornell, had practised law in New London, and for nine years had served as judge of the Court of Common Pleas for New London County. He then became president of the New London Northern Railroad Company (1904), but three years later was appointed by Theodore Roosevelt as United States Circuit judge for the second circuit. This made him *ex officio* a member of the Court of Appeals. Noyes had served on a number of important patent cases, and was already recognized as an expert in that particular field.[46] At last Parker had "a patent judge!"

The oral hearings were brief. Each side was alloted but four and a half hours, the court sitting three hours daily; but soon after proceedings began an additional hour for each was given on Friday, November 25. For the Ford defense Gifford spoke the entire four and a half hours, except for a presentation of perhaps forty minutes by Coudert on behalf of his French clients. Wetmore took the final hour. Betts, Redding, and Fish (who closed the case) spoke for the complainants.[47]

The three judges listened courteously throughout the oral arguments, which did not differ greatly in material, although somewhat in emphasis, from those of 1909. Gifford, in the oral presentation as in his written brief, drove hard at the character of the patent as determined by Selden's original application and the state of the prior art. His effort was what Parker's had been, to establish the special character of the document, and in speaking and writing he and Wetmore came to the point of their presentations at once.

Coudert made an excellent oral argument, one aspect of which centered about the pronouncements of Dugald Clerk. These were of course on record in his testimony as a witness, and were favorable to Selden. But Coudert dramatically produced a copy of the most recent edition of Clerk's book on gas and gasoline engines, suggesting: "Let us see what Mr. Clerk has to say about it [i.e., what he had to say about the Selden engine in his book], not Clerk with a retainer in his pocket"! The retainer, he conceded, was entirely proper; but Clerk was after all an author, an authority to be found in print, and what did he have to say in such a capacity? Coudert was emphatic in his

reply. "This man who for six years was their retained expert," he asserted, ". . . has not a word in his book, not a single syllable, about Selden."

Coudert pointed out that Clerk attributed the development of the automobile to Daimler's high speed, four-cycle engine—"strange he doesn't say Selden's engine." Otto, Daimler, and Benz—these were the men Clerk in his book credited with producing the automobile. He had even said of Brayton's engine: "No one, however, has yet succeeded in carrying his type of engine further than he did." So according to Clerk—in print—Selden hadn't even improved on Brayton!"

Coudert also attacked the operable character of Selden's car as shown in the patent and examplified in Exhibits 89 and 157. For if these two vehicles would run only a few minutes, they were no better than Rosenwald's, which Clerk had testified might do the same. In eight months Selden's two "Chinese copies," despite constant effort, had traversed a total distance of only eight miles. "Rosenwald and Lenoir beat them all to pieces, because Lenoir went from Paris to Joinville-le-pont and returned within three hours, according to Mr. Clerk—in three hours. And the distance is twelve kilometers each way. I have been there back and forth on a bicycle and I know. . . . Lenoir, fifteen years before Selden, did it in that comparatively short time." Even though Exhibit 157 embodied many modern improvements, Coudert pointed out, it still would not operate like a usable car. Clerk had said in disparagement of an old steam road wagon that it only ran three and a half miles per hour. "But this engine only ran a mile a month!"

Fish later wrote Coudert a note congratulating him upon his oral argument—"a very fine piece of work, excellently organized, very well delivered."[49]

However, it was not the oral arguments chiefly, but the testimony, the exhibits, and the briefs which would most affect the decision. The three judges retired with this material and in about six weeks, on January 9, 1911, Noyes read the decision which presented their common opinion.[50]

His approach was logical and searching. Noyes first took occasion to note Hough's decision, and to express indebtedness to it, although "we may be unable to adopt the conclusions of his very able opinion." Like Hough, Noyes brushed aside the argument that the

delay in taking out the patent could be a cause for ruling against it. "If the statutes and rules permit unnecessary delays they should be changed, but we reject the view that this Court owes any duty to relieve against their operation." The patent should be regarded with complete impartiality. Noyes examined it, quoting its first claim in full. He also noted the alternatives upon which the defendants had insisted: "(1) That if the patent be broadly construed it is invalid; (2) that if it be construed less broadly, but according to legitimate rules of construction, the defendants do not infringe."

Noyes, remarking that the factors of novelty and invention were intertwined and all but inseparable, proposed to "test the question of the validity of the patent by the answer to the inquiry whether it discloses the exercise of the inventive faculties in view of the prior art." Pointing out that most of the elements in Selden's combination were old, he settled upon "the engine element" as the feature of the patent and the factor requiring "the most extended consideration."

Selden, Noyes noted, had specified "a liquid hydrocarbon gas engine of the compression type." Such engines existed in 1879, the Brayton and the Otto being the two outstanding types. Of course no novelty or invention could lie in the mere use by a motor vehicle of a gas engine or even a liquid hydrocarbon gas engine as a power plant. The novelty, if any, would lie in the compression element.

However, evidence existed to show that even here the novelty was not clear. Brayton engines had already been used in boats and streetcars (1874), in the latter achieving a "mechanical" though not a "commercial" success. "The use of the engine in one vehicle pointed directly to its use in another vehicle." Noyes took note of Brayton's omnibus experiments, but ruled that these "will not be considered in the antecedent art."

It was at this point in automotive development, Noyes continued, that Selden had filed his application. He showed a particular type of engine but stated: "Any form of liquid-hydrocarbon engine of the compression type may be employed in my improved locomotive."

Thus on its own terms the patent claimed was a broad one, the engine shown in connection with it merely being the patentee's conception of the best method of application. "And," remarked Noyes, "if the prior art permitted such a patent in this case it might well be that it would be valid." However, at this point he differed sharply from

Hough. "But the prior art did not permit such a patent. Every element in the claim was old, and the combination itself was not new." Here Noyes took account of Rosenwald, Hilton & Johnson, and of Brayton's experiments. If a broad interpretation was sought, Selden's claim was therefore invalid, as was also the narrower claim utilizing the Brayton engine only, for that engine had already been used.

"But we are reluctant," Noyes announced at this point, "to so construe the claim that it must be held invalid for want of invention." He felt that Selden had ideas "ahead of the times" and that he "appreciated many aspects of the problem to be solved in creating a practical motor vehicle." Selden, moreover, had perceived the problem involved in adapting an engine to a car or wagon. Noyes recognized that the patentee had made "material improvements"—among them an enclosed crankcase, a plurality of cylinders, and increase in speed. He had thus introduced a "novel element" into the combination, although his improvements were only relative in character. He had not, for example, created a high speed engine except in comparison with Brayton's (Daimler's, of course, had been the first to achieve really high speed). But the patent could be held valid if the structure it showed was operative, and Noyes held that such was the fact; although again "any contention that a motor vehicle constructed by the patentee according to the teachings of the patent operated so successfully as to demonstrate that Selden had solved a great problem and is entitled to the status of a pioneer inventor, is, we think, without foundation."

Thus Selden held a restricted patent—that for a vehicle employing Selden's modified Brayton engine. Did the defendants infringe this patent? Noyes went briskly and convincingly into the difference between the Brayton and Otto types. He summarized these by contrasting the Selden and Defendants' engines:

Selden engine	*Defendants' engine*
External compression mechanism	Compression in working cylinder
Two-cycle engine	Four-cycle engine
Constant pressure (non-explosive)	Constant volume (explosive)
No distinctive external vaporizing device	Carburetor
Constant flame ignition	Timed electric ignition*

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* The arrangement in parallel columns is my own, and represents merely a digest of Noyes's comparison of the two types of motor.

The two lists of characteristics, he held, represented "differences in principles and things," not merely in terminologies and theories. Clerk, said Noyes, had considered the difference between constant pressure and constant volume so great that he had made them the basis of classification in his book, "and, notwithstanding his present testimony, we must regard them as substantial." The "range of equivalents" which custom gave to any inventor did not permit Selden to include Otto type motors as falling under his patent. Selden, while showing great appreciation of the problems involved, had made a wrong choice in practice. "We can see that had he appreciated the superiority of the Otto engine and adopted that type for his combination, his patent would cover the modern automobile. He did not do so . . . and we cannot, by placing any forced construction upon the patent or by straining the doctrine of equivalents, make another choice for him at the expense of these defendants, who neither legally nor morally owe him anything." The victory for Ford was decisively complete.

7.

It was now the anti-Selden forces who made a dozen cities the scene of their jubilation. Dozens of telegrams and letters poured into the Ford offices, many from opponents as well as from friends. Ford officials and dealers beamed. We can guess the joy of Ralzemond A. Parker, who found his long fight crowned with success at last.

Prompt to flash his word of approbation was Charles T. Jeffery of Thomas B. Jeffery & Company, the son of the man who, it will be recalled, had stood as a staunch independent from the beginning, and narrowly escaped being in Ford's place legally. "Your determination and courage have surely won for you the admiration and respect of the whole automobile industry," ran Jeffery's message. Later his company was to send $10,000 as a contribution to the costs of the case; this sum the Ford directors voted to distribute among the defense's legal staff.[51] Others who sent similar greetings were Charles E. Duryea ("I hope the great American public will awake to the result and not fail to appreciate the champion of their rights against trust methods"), Charles B. King ("Hurrah for Henry Ford!"), H. S. Firestone, Homer Warren, Richard P. Joy, and a number of importers and manufacturers. The Detroit *Journal* hailed the judgment as widely beneficial to the industry. "The Court's decision . . . is a declaration of liberty

and equality of opportunity." Many other papers echoed this sentiment or expressed a similar approbation.[52]

Noyes's decision was accepted as final almost before the echo of his last word had died away. If any disposition to appeal existed, it was never publicly expressed. Indeed, a study of the opinion would have daunted any attorney supporting the patent. The decision was too precise, too well buttressed by facts, too clearly in line with automobile history and social ethics to be effectively challenged. The proof of A. L. A. M. acceptance was prompt. In New York automobile men were gathering for the annual shows, and an invitation was extended to both Ford and Couzens to attend the Association's annual banquet on January 12. Ford told a reporter for the Detroit *Free Press* on the 11th (as he and Couzens were entraining for New York) that they would attend. He declined to comment on the decision. "Whatever I'd say now might sound like boasting," he explained modestly. "I think the decision speaks for itself."[53]

On the 12th the *Journal* told the story of a Detroit A. L. A. M. member whose president called up the cashier's office to learn if the check for the quarterly royalty had yet been dispatched to the Association.

"It has not," was the reply.

"Then hold it back," commanded the president in "gleeful tones." When this occurrence was reported to Couzens he remarked: "I guess there will be more checks of the same kind held back."[54] Actually, the A. L. A. M. members were delighted that their days of "tribute" were ended.

This feeling was expressed at the A. L. A. M. banquet, where Ford and Couzens were received with generous applause and tribute after tribute was paid to both, alike for their courage in fighting the suit through, and for their accomplishments as manufacturers. "The pipe of peace was smoked literally and figuratively," reported *Automobile*, "by Col. Charles Clifton, President of the A. L. A. M., and Mr. Ford while the banquetters cheered."[55]

The following evening the Ford forces gathered at Rector's, and their former opponents were now received as guests. At tables decorated with crimson carnations and loaded with choice food the one-time enemies now sat in friendly conversation. At the speakers' table Judge W. Benton Crisp presided, with Ford on his right, Couzens on his left, and Parker, Redding, Job Hedges, Alfred Reeves, Edsel Ford,

Harvey Firestone and others as companions. Again tributes were paid to Ford, Reeves declaring with a third shift of attitude: "Henry Ford is the greatest man in the automobile world, and . . . the Ford organization is the greatest automobile organization in the world." A colored quartette played and sang, the audience joining in the chorus of well-known songs.[56]

While the legal representatives of the pro-Selden group spoke graciously and flatteringly in their hour of defeat, Betts at least found the Noyes decision a hard blow. Frederic R. Coudert used to twit him about losing the great case, and while Betts for a time took these reminders well, one day he said in a burst of feeling: "I wish you'd never refer to the Selden case again! It broke my heart. I told my clients we'd win it, and I thought we could. I never want to hear of it again."[57] Coudert was startled, but respected the feeling of his friend and former opponent. "It wasn't his fault," he concluded. "They had an excellent office—one of the best. But they were on the wrong side of the case."

Quite naturally Ford's feeling, and doubtless Parker's, was of an entirely opposite character. To his family and friends he made no secret of his delight in connection with his victory. "If we had not won the suit," he declared on one occasion, "there could never have been in this country such an automobile industry as exists."[58] To him it had been a fight for freedom in the deepest and most satisfying sense.

It was so accepted everywhere. Ford was the giant-killer, the symbol of revolt against monopoly, although he was rapidly becoming one of the wealthiest of Americans. No one disputed his title of heroic individualist—it was accorded gladly by many of his former opponents. Although they argued that A. L. A. M. had played a useful role in building up the industry, they conceded that its defeat was in the public interest.

Ford liked to believe that even Selden was victim rather than villain. "He was a decent old fellow," he remarked after describing a meeting with his former opponent. "But when others began to make automobiles, he got into the hands of those who wanted to exploit the industry by claiming tribute from every motor car manufacturer."[59]

This was an amiable version of Selden's role, for the Rochester lawyer had sought from 1895 on to find some ally who would enable him to collect royalties, and he was a delighted recipient of those he got

from the A. L. A. M. He had convinced himself that his patent was a complete proof of his high position in automotive history, and that *he* was really the father of the automobile. "Morally the victory is mine," he said on his deathbed.[60]

8.

When the applause and shouting had died away, what were the practical consequences of the great action?

Of course an enormous bill for expenses had to be met. Parker remarked not long after Noyes's decision, implicitly referring to the growth of the automotive industry during the progress of the suit: "It became of more financial importance than any patent case that had ever been tried in the United States." It was of course true that the industry had expanded enormously since 1903. If it had then represented a capitalization of $97,000,000 by the loose and exaggerated estimate of $70,000,000 for the "trust" and $27,000,000 for the independents, it was close to half a billion in 1911. A realistic appraisal would probably be several hundred millions. The stakes of the suit *were* high.

Parker stated at the same time that "the cost alone of the cases were [sic] probably in the neighborhood of $500,000," and this was undoubtedly a conservative estimate.*[61] The sum would comprise the legal fees for both prosecution and defense, the fees of experts like Clerk and Carpenter, and the expenses of witnesses and of printing. Actually the suit had cost much more. The advertising campaigns alone were high. The time spent in promoting such organizations as the A. M. C. M. A. and separate auto shows, the effort expended on the suits by men like Ford, Couzens, Anderson, Gray, Day, Reeves, Budlong, and others—such costs, none strictly set against the suits, would have doubled or tripled the bill. They were absorbed by the various organizations concerned.

The complainants bore the actual costs; they also, with the limitations put upon the patent by the decision, ceased to draw any revenue from it. That revenue had been dwindling. The approximate total amount paid has been estimated—perhaps excessively—at $5,800,000, of which Selden had received $1,160,000, less the half he had paid to George H. Day. The patent-holder's share thus seems to have been

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* According to his son, Parker himself profited little from the Selden case. He did not charge a large fee, but only a reasonable sum per day while actually working on the case, and reduced this by giving a sizeable discount.

$600,000 or more. (There is no evidence that payments to Day's heirs were continued after Day's death in 1907.) All in all, the royalties were large for a patent that eventually was adjudged not entitled to draw them.[62] The A. L. A. M. continued its life for a year, dissolving itself on January 11, 1912. Its members voted to arrange for the Automobile Board of Trade to take up its role for the improvement of the industry.[63]

The Selden patent case had a considerable effect, which is difficult to assess precisely, in promoting reform in the patent laws and in the procedures governing patent suits. Agitation for improvement in both statutes and procedural practice had been under way before the suit began. However, as it progressed the cry for betterment became louder and stronger. Judge Hough's previously-noted criticisms of procedure were pointed, and were embodied in a long footnote early in his opinion.

Hough inveighed against "the methods of taking and printing testimony in Equity, current in this circuit (and probably others), excused if not justified by the rules of the Supreme Court, especially to be found in patent cases, and flagrantly exemplified in this litigation." He remarked that "as long as the bar prefers to adduce evidence by written deposition, rather than *viva voce* before an authoritative judicial officer," the abuses would probably remain. "But reforms sometimes begin with the contemplation of horrible examples," he continued, and went on to list the evils produced by the current methods of procedure. These included the enormous volume of the total record; the needless repetition of testimony; the duplication of exhibits; the recording of squabbles over such routine matters as adjournments; the objections "stated at outrageous length"; and disputes in language "uncalled for and unjustifiable, from the retort discourteous to the lie direct."[64]

Hough's protest undoubtedly had its effect. It was quoted by advocates of reform, and must have been considered by the Supreme Court. Of course, as Parker pointed out in a letter to the *Scientific American* in April, 1912,[65] the Selden case was angrily used as an example of waste without a full understanding of its character. Referred to as a single litigation, it actually comprehended five suits, and the record would have been cut down greatly had testimony not been repeated and exhibits offered separately, for both the Ford and Panhard actions.

Parker made the same point in an undated letter, presumably written in 1911 to H. M. Campbell. Aware of the necessity of taking testimony from witnesses unable or unwilling to appear in court, he felt that the process was not as easily disposed of as had commonly been assumed. He favored the consolidation of testimony when a number of suits bore on the same question, advocated the restriction of depositions, and felt that proper examiners could have additional powers designed to compel responsive answers and exclude irrelevant material.[60]

Immediately after its conclusion the Selden case was used freely as a "horrible example" by writers on patent law and procedures, notably Waldemar Kaempffert, L. H. Baekeland, and Robert Kenyon.[61] It may have aided materially in the drive to expunge the abuses which it represented.

Finally, what of the effect of the case on the Ford Motor Company and on the industry in general?

As for the industry, automobile manufacturers everywhere were undoubtedly rid of a mental incubus, and manufacturers who had previously been sued were now able to prosper or fail according to their respective abilities. The A. L. A. M. materially restricted enterprise, discouraging potential investors and acting as a damper on the expansion of established companies. After Hough's decision, its influence was marked and disruptive. However, it would probably have issued licenses to most applicants, and anyhow would not have held its powers long had they been confirmed. In 1910 the patent had less than three more years to run. It should be pointed out that despite suits, despite advertising and publicity, and despite pressure on the dealers of independent firms, the industry as a whole had shown vigorous growth throughout the entire period of A. L. A. M. activity.

As for the Ford Motor Company, for many years a stubborn belief persisted that the decision released an immense fund which it had set aside to pay Selden, had he won, his pound of flesh. This legend was quite as unfounded as the conception that the expense of the suit impeded Company development—an idea which evaporates at once when the enormous profits of the organization from 1903 to 1911 are considered. The Detroit *Journal* had heard rumors of the fund, and asked Couzens about it on the day after Noyes's decision. "There is no such fund," promptly replied that official. "We were never

afraid of the outcome, and, besides, could have met the damages, if any, by ordinary financing methods."[68] Again, the financial record of the Company abundantly supported Couzens's declaration.[69] Undoubtedly the suit had exercised some limiting effect upon the Company's plans for expansion. In a booklet among the Ford legal records, the case of the Keim Steel Mills of Buffalo is mentioned. When on January 31, 1910, a proposal was entertained by the Ford directors for the purchase of this property, they decided against it. "However," says the booklet, "just as soon as they won the Selden patent case in January, 1911, they took it, as the minutes show, and moved it to Detroit. It was part of their expansion program . . . but they dared not take it until they won the Selden patent case."[70]

In this and other particulars the settlement of the suit undoubtedly quickened the tempo of expansion. The Ford Motor Company had never stood immobile to await a final decision; but it marched forward with greater confidence than ever, and with a new sense of freedom, once its right to manufacture without tribute had been vindicated.*

9.

It has been said that Edsel attended the banquet given by the Ford Motor Company to celebrate its victory. Now in his eighteenth year, he was still in high school, and slipped away from his studies to take the train for New York and be present at Rector's on the night of January 13. This event is recorded in a diary which he kept for January and a part of February, 1911. The jottings in this little book do not tell us much about his personality, except to indicate that he was a well-balanced and quiet youth, and that he was more interested in the Ford Motor Company than in his lessons! (The only composition by Edsel of a number surviving from his school days which drew praise from a teacher is a description of an automobile plant.) There is one touch of excitement in the diary—on January 10 he records in Caps: "HEARD THE NEWS, WON THE SELDON SUIT." Concerning the banquet itself he merely records: "Went to Ford banquet. Good time. Fifty there altogether."[71]

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* For a fuller account of the Selden patent case, the interested reader should consult the study on this litigation now being prepared by William Greenleaf, who assisted greatly in providing material for the two chapters in this volume. The story as told here is relatively brief, and omits a wealth of colorful material.

In the diary we have a glimpse of Edsel at school. He trained a little for track, and placed third in the thirty-yard race (or is this a miswriting for 300?). One morning "my car would not start," and he went to the factory for Ed Kulick, who soon had it running.

On January 17 Edsel went out to "the farm," a large tract of land which his father was buying in the Dearborn area, including the old Ten Eyck acres, where he took pictures "of the dam and cattle." All of this would later be the grounds of Henry Ford's home, Fair Lane. Ford had a "bungalow" there which all the family used increasingly, and a power house on the River Rouge, which he had dammed up [illegible] this point. A year later, on February 25, 1912, Clara recorded in her diary that all three of them "went to farm, I put on rubber boots and tramped 4 miles."[72]

But the chief event in Edsel's life, as in that of his parents apart from the industrial success Henry Ford was achieving, was a trip to Europe made in the summer of 1912. It was not wholly a pleasure jaunt, since Ford wanted to see what his subsidiary organizations were doing in England and France, but for all three it was a new experience, with [illegible] definite personal interest because of the fact that Clara's mother had been born in Warwickshire. In a sense, too, it was a holiday that Ford would not have taken while the Selden suit was still undecided.

Both Clara and Edsel kept diaries of this journey. Neither is distinguished, and the young man's seems particularly colorless when we consider that he was almost nineteen. Clara was stirred when their ship, the *George Washington,* put in on July 20 at Plymouth, and voiced her delight: "All seemed spellbound with the beautiful scenery, looked as if it had been painted." Perry was there to meet them, and under his guidance, taking their way by car, they saw Exeter Cathedral, Bath, Windsor Park and Castle, and many other sights along the countryside. They visited London, staying at the Piccadilly Hotel, and then took their way to Kenilworth Castle, Stratford, and Warwick, Martha Bench Bryant's birthplace. Clara found her mother's "old home and garden" on Linen Street. "Stood on the stone steps leading to the garden & Edsel took my picture."

Castles, cathedrals, and gardens interested Clara, but Henry and Edsel were perhaps more excited by the factories of England, and the long talks Ford had with Perry about the English prospect for the Ford car.

They stayed for a week at the Perrys' home outside Manchester. This comprised "a fine old house" and five acres of ground with garden, orchard, and bowling green. Ford took to bowls, and Perry presented him with a set. Later on, the three men went through the Napier factory, the Ford assembly plant, and other industrial establishments, and attended at least one auto race, Ford presenting a silver cup to the winning driver, who had piloted a car made in the Ford factory.

About August 10 the family left for France. In Paris they were the guests of the Ford representative, H. B. White, had a good time, and boarded the *George Washington* at Cherbourg on August 25 for the return trip.[73]

They were no longer untravelled Detroiters. They had seen the world. More important, Ford had studied at first hand the factories of England, and discussed production and sales problems in foreign countries with the men who had the responsibility of developing the ever-broader market for Ford cars.

Couzens, as previously noted, had made a European trip in 1907, and later, in 1909, he undertook another. Like the Fords, he and his family had adapted their way of living to their increasing wealth. Kahn, the architect of the Highland Park plant, had designed a fine brick house for Ford's associate which rose at 92 (later 610) Longfellow Avenue. Meanwhile Couzens had developed a farm near Pontiac, Michigan, with a comfortable white frame house, and this became his summer home. He named it "Wabeek," an Indian word meaning "the best place," which he had found in the *Saturday Evening Post*. He enjoyed retiring to the peace of these acres as Ford enjoyed "the farm" at Dearborn. "I go about looking like a farmer, with no one to bother me," he told a Detroit *News* reporter. He raised blooded cattle, and found enjoyment in watching his herds develop. "My cows don't talk to me, don't ask questions, nor criticize my way of doing things."[74]

Percival Perry visited Couzens here, and recalled how the two were walking about the place when an employee came up and said something to Couzens. The latter nodded. A little later the man appeared and spoke to him briefly again, and Couzens seemed perturbed. However, he said nothing until they reached the house, when he remarked: "That was the fastest I ever lost $1000." He explained that he had

two cows, Mary and Betsy. The worker had first told him that Mary had died; when he came again it was to correct his first bulletin—the cow had been Betsy. "Betsy," said Couzens, "was worth just about $1000 more than Mary."[75]

Couzens brought his parents to Highland Park, and provided amply for his brothers and sisters. His wife bore him a fourth child—a daughter, Margo, in 1910. He took pains to keep them all unspoiled, even telling Madeleine, who exclaimed on reading about the prosperity of the Company, "Whew, that's a lot of money we have!" that the money was a trust—not really theirs. This explanation puzzled the girl considerably. He was rather severe with all the children, trying to teach them to avoid ostentation but to accept the responsibilities of wealth. He and his wife were inexpressibly grieved when their eldest, Homer, was killed on August 8, 1914, near Wabeek in a Ford car that Couzens had given him on his fourteenth birthday.[76]

Both parters were living without conspicuous luxury, avoiding public notice, and working hard at their business. In the years 1911-13 both, but particularly Ford, were intensely interested in revolutionary changes at the factory: changes which opened a new era in industrial technology.

XVIII

A LEVER TO MOVE THE WORLD

"Born, in 1913, at Highland Park on the outskirts of Detroit, a new world force, the system of mass production, destined to affect all economic and social life"—that, at the time, would have been a bold and incomprehensible announcement. But although the birth of mass production cannot be attributed to a single year or one industrial plant, the statement would have contained enough truth to be arguable.

Could it have been possible to bring back to earth in 1911–13 the unfortunate John Fitch of steamboat memory, or the Chauncey Jerome who had glutted the market with cheap Connecticut clocks, or the Eli Whitney whose machines had made ten thousand musket locks precisely alike, or the Samuel Colt who as a sailor got the idea for his revolver from watching a ship's paddlewheel, or the Cyrus H. McCormick who in one year had made more than fifty thousand reapers and mowers—could these men have revisited the America of Taft, where in the industrial scene would their curiosity have found its richest feast? The typewriter factories would have fascinated them; so would the huge textile mills, ready-made clothing establishments, meat-packing plants, and workshops for telephone sets and electric lamps. They would have studied with eager interest the cigarette industry, the safety razor factories, the quantity production of shoes, canned goods, and magazines. But probably they would have gone to the machine shops first; and there every foreman would have given them the same advice—"The automobile factories are our real pioneer zone."

The United States, which had taken the lead in motorcar manufacture over France in 1906, was making as many automobiles four years

later as all other nations combined; about two hundred thousand, in fact, of which all but five thousand were gasoline driven.[1] American automobile factories, highly competitive in designs, ideas, and methods, took rank among the most advanced engineering laboratories on the globe. The bigger plants had every resource for initiating and testing new principles. The Buick Motor Company, for example, which by the end of 1911 boasted that it had at Flint the largest automobile factory in the world, made nearly all its own parts. In a plant which looked like a city in itself, it possessed its own ignition works, body works, varnish works, spring works, hub and cap works, wheel works, gray iron foundry, and brass, bronze, and aluminum foundry. The White Company bragged that the main engineering features of its six-cylinder gasoline car had been recognized or adopted by practically all European manufacturers. Companies sought the best engineers in the market, paid them unprecedented salaries, and made capital of their fame. Thus the Hupp Company gave prominence, in advertising its $750 runabout and $900 five-passenger touring car, to the contributions of the chief engineer from its inception, E. A. Nelson.[2]

Certain trends in the industry were now pronounced. The practicability and popularity of the moderate-priced car were fully established. Experts agreed that by 1910 it was easy to acquire for a thousand dollars or less a better automobile than three thousand dollars would have brought in 1905. For long-distance travel, for high speed, for dignity and comfort, the costlier cars were preferable. Those who could afford it found solid reason for purchasing the Marmon, for example, an Indianapolis car of fine finish which won the International Sweepstakes ("the *greatest contest* the world has ever known") on May 30, 1911, covering five hundred miles in just over four hundred minutes, and defeating three Italian Fiats, two German Benzes, one Mercedes, and other famous models. A preference could well be argued for the National at $2600–$3000, the Oakland at $2100, or the Pierce-Arrow at $2500 up.[3] Nevertheless, many people who could afford the large cars, as well as multitudes who could not, bought the Ford, Hupp, or Studebaker instead. These could dodge about in dense traffic with the agility of a small boy; they were parsimonious of gasoline; they used cheaper tires and kept them twice [illegible] long; they slipped through country mud and dust with the spryness of a buck-

board; they were more easily controlled and hence safer. Moreover, somehow, for obscure psychological reasons, the owner of a small car developed a fondness for it seldom felt for a large model; it became a family pet, and before long he could be seen tending it with real affection.

Would not the next great step be a spectacular price reduction? Within a few years, wrote one expert at the beginning of 1912, the satisfactory $500-car might become an immense factor in the automobile business. The production of a reliable machine at such a modest price, to be sure, was far more difficult than most people realized. "The only way it can be done is by turning them out in enormous quantities"; and that would require capital—a capital large even in the automobile business. "There is no doubt, though, that the man who can successfully solve this knotty question and produce a car that will be entirely sufficient mechanically, and whose price will be within the reach of the millions who cannot yet afford automobiles, will not only grow rich but be considered a public benefactor as well."[4]

The larger factories were steadily being better equipped and more expertly managed. American metal-working machinery had now become the best in the world and was being the most rapidly improved. Machine tools of Yankee design were used in British bicycle plants, British and French automobile factories, Swiss watch establishments, and Belgian and German small-arms works. As the automatic and semi-automatic principles were applied on a broad front, unprecedented advances were made from 1900 to 1912 in lathes, planers, milling machines, grinding machines, borers, and drill presses. Such devices as the pneumatic portable drill and pneumatic riveter, developed during the 1890's, and quick gear-changing devices for controlling the speed of machine tools or changing the scale of their operations, proved invaluable. So did machines like the so-called automatic multi-spindle drill, with as many as five tool-holding or work-holding spindles. With every improvement came an increase in working capacity, ease of manipulation, and precision of product. An English commentator wrote in *Cassier's Magazine* in 1909 of the remarkable new gauges, templates, cradles, and jigs to be seen in some American industries where millions of articles were made in duplicate at low cost. "In connection with these are many special machines for turning, spinning, drilling, boring, milling, and grinding, each of which is made

to perform its work upon the particular piece of the product manufactured. . . . Their speed of production is, in many cases, almost marvelous."[5]

As quantity production of farm implements, arms, bicycles, typewriters, and other wares grew, nurseries of mechanical talent appeared which schooled young men suited to the coming mass-production age: men with a firm grasp of factory procedures based on power machinery, the departmentalization of manufacture, and the use of the latest jigs, patterns, and high-speed tools. Great Britain by 1900 had ceded to America the primacy which it had held during most of the nineteenth century. "In the United States," wrote the observer just quoted, "there have been developed during the last twenty or thirty [illegible] years a bree[illegible] and works [illegible] characteristics in one man to make him thoroughly [illegible] organize and operate a factory for producing good work on the 'duplicate system.' Not only must such a man know how to make a typewriter or sewing machine, but . . . he must know how not to try to make the machine complete, except as a matter of the final assembling of a group of perfectly fitting (not fitted) parts." These master mechanics of managerial capacity had been found of old in the Colt and Remington arms works, the Singer sewing machine factories, the Studebaker wagon works, the McCormick and Deering harvester plants, the Sellers machine tools shop, and the Pope bicycle factory. Now some of the very ablest were to be found in the large automobile manufactories.

Departmentalization, which the McCormick factory had carried to a high point and which had become still more elaborate in the huge Standard Oil organization, had developed on functional lines in the automotive industry. The Cadillac Company, for example, by 1909 was carefully organized on both the business and production sides. It had a purchasing department, a time-keeping and cost-accounting department, a production superintendent with assistants, an engineering department, a design department, forty-four different manufacturing departments, each with its foreman and assistants, and six special departments![6] The same minute subdivision could be found in the Buick, the Olds, the Studebaker, and other large factories. Of course this departmentalization required a correspondingly complex system

for charting stock inventory, the transfer of materials, job routing, and the precise state of each assembly-line at a given moment. It was imperative that authority in each plant be centralized, and that orders from executives be rapidly and accurately transmitted. The battle for a successful season of production might be lost by a few blunders or delays.

In some automobile plants, like the Hupp, immediate authority over production rested with the chief engineer; in others, like the Ford, with the general manager or superintendent. Whoever the head was, he had to think of each day as an Austerlitz and himself as Napoleon. At the Regal plant in Detroit, which in 1910 was producing cars in job lots of a hundred each, the manager demanded continuous reports from every department. "Every operation necessary to the completion of a hundred cars is made in unison, and, if there is a laggard anywhere, he is smoked out, for the simple reason that the lockstep is broken. At ten o'clock every morning the executive head is in full possession of information relative to weak spots only. Things which progress on time do not have to be investigated."[7] Before long an outstanding chief engineer or superintendent, a man like Flanders, Knudsen, Sorensen, or Chrysler, would become a national figure.

2.

If the Ford Company was to realize its founder's dream of a universal cheap car, it would have to thrust its engineering, factory arrangement, and production techniques beyond the van of the industry's general progress. It must go far beyond the accomplishments of the Olds, Hupp, and Cadillac companies. The story of its construction of a bold road across the difficult terrain of low-cost quantity manufacture to reach the goal of mass production is one not easily matched in our industrial history.

Three memorable events of 1910–11 opened the way: the removal to the Highland Park plant, the winning of the Selden patent suit, and the acquisition of the John R. Keim plant in Buffalo. Of these, the occupancy of the new factory was much the most important.

Couzens, Ford, and their associates had been proud of the enlarged Piquette Street plant; "as good as, perhaps a little better than, any automobile factory in the country," wrote Ford later. They were prouder still of the "Crystal Palace," as some called the Highland Park

building which the architect Albert Kahn, assisted by the Ford construction engineer, Gray, was erecting in 1909. Drivers on Woodward Avenue, then "away out in the country" northwest of Detroit, had seen the main structure rising on the plain, uncompromisingly utilitarian in its rectangular lines, but giving an impression of lightness and airiness in its immense window spaces. All of it save the ornamental brick bastions at the four corners was built of steel, concrete, and glass—more than fifty thousand square feet of glass, letting in floods of sunshine on bright days. With its four stories, its length of 865 feet, and its breadth of 75 feet, it was the largest building under one roof in Michigan. The directors had appropriated a quarter of a million for it and a power plant, while supplementary sums were soon voted for other erections, notably a foundry.[9] The tract of sixty acres before long was almost filled with buildings.

Some critics just after the panic of 1907 had thought that the company was expanding too fast, and men even caught on the Michigan breezes the question "How soon will it blow up?" The success of the company being manifest, this jealous skepticism would not have been widespread; but it was not weakened when Ford one morning in 1909 made public announcement that thereafter he would build only one model, that this would be the Model T, and that the chassis would be identical for runabout, touring car, town car, and delivery car alike. Three years later, in 1912, he decreed that they would all be ebonied with the same hue. "Any customer," he remarked to Sorensen at a meeting of officers, "can have a car painted any color he wants so long as it is black."[10] Quantity production at low prices demanded simplicity and uniformity. He reiterated the policy of building at low prices for the multitude. In point of fact, the price of the roadster went up $75 in the season 1909–10 and that of the touring car $100. This price-rise, however, was but a temporary measure to help pay for the Highland Park plant.

The move from Piquette to Highland Park was formally accomplished at New Year's, 1910—without a brass band, a ball, a clambake, or even a speech from the mayor, as the *Ford Times* remarked. On the last day of the departing year the company was shipping all its cars from the old factory; on the first day following, a good part of them were moving out of Albert Kahn's shining structure. As yet only about a quarter of the plant was finished, and of course the transfer

was made department by department. The part first finished contained the most important elements: the machine shop for making engines, transmissions, and axles, the main room for assembling cars, the radiator shop, the painting room, and the shipping room. Almost finished was the power house, while work was about to start on the huge foundry, ultimately 200 by 200 feet, and on a handsome four-story brick and stone office building just in front of the main structure on Woodward Avenue.[11] Much new machinery had been bought for Highland Park, and the old machinery worth keeping was rapidly moved into proper position alongside it.

Building went on almost without halt for the next few years, until a series of well-planned structures covered the grounds.* The plant was of course geared to the railroads which reached it on the north: the Michigan Central, the Grand Trunk, and the Detroit Terminal Railroad. The general plan of the original buildings, completed before the summer of 1914, was simple and convenient. Fronting on Woodward Avenue, the main structure, as we have said, was of four stories, a sixth of a mile long. Paralleling it for almost its entire length was a much wider one-story structure 840 feet long and 140 feet in breadth, with a saw-tooth roof, the machine shop. Between these two large buildings extended a craneway, 860 feet by 57 feet, with travelling cranes as wide as the way beneath. A transverse craneway also entered the machine shop. Side-openings in the main building and in the machine shop made it easy to deliver materials from the craneway, or to transfer materials across the craneway from one building to the other. Indeed, the two units might really be considered *one* great building, with a skylight-roofed craneway running down the middle and another extending to one side. The heavy machinery was all placed on the ground floor, and it was here that the manufacture of the chassis and most other parts was carried on. The three upper floors

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* The principal additions to the original plant were designed by Edward Gray, chief con-[illegible] He testified to the Additional

of the main building were devoted to a variety of uses, which we shall presently specify.*

The design of the plant was in advance of anything previously known to the industry. Frederick J. Haynes, chairman of the board of Dodge Brothers, testified later that in 1913 the Ford Company possessed the best factory arrangement for car production known in the country; and this was the general view. F. L. Faurote, author of books and articles on automobile manufacturing, declared that this was one of the most efficient plants he had seen anywhere; and the Ford construction engineer, Gray, was satisfied, after visiting all the other principal car manufactories, that the Ford Works were unequalled.[12] A succinct description offered by experts in a subsequent legal action emphasizes some of the advantages of Highland Park:

> The buildings were unique and different from previous factory construction. They had a craneway between each pair of buildings, the roof of the craneway being glass, so that there was a continuous light well the length of the building. It was not necessary to put sides in those buildings, other than the street side, so that the buildings were not encumbered with walls or partial walls. The heating plants with air washers were on the roof so that they could not only heat, but also ventilate and cool the buildings. The waste air on its way out of the building heated the craneway without any expense.
>
> Galleries were built on either side of the craneway, to enable workmen to unload a car of material or a car of finished product directly from any point in the gallery. The design of the building was such that raw material was hoisted as near the roof as possible, letting it work down in the process of manufacture. Thousands of holes were cut through the floors so that the parts that started in the rough on the top floor gravitated down, through chutes, conveyors, or tubes, and finally became a finished article on the ground floor.[13]

Suppose a visitor arrived by way of the Detroit Terminal Railroad to visit the works. The railroad would carry him first past the foun-

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* Unquestionably Albert Kahn and the Ford Company construction engineer, Gray, had profited from [illegible] White Company [illegible] s following the [illegible] ate communica- [illegible] y-tooth roofs to [illegible] e entire length [illegible] ant buildings [illegible] l trucks, which [illegible] any of the departments, or from which the overhead travelling crane could lift heavy pieces. ("In the Making of a Steam Car," *Automobile*, XVII, No. 12, September 19, 1907, 401, 402.)

dry, a grim building that was regarded as the least successful of the lot, past the sand storage bins, and past the heat-treatment laboratory for steel. He would be whisked past the ends of the machine shop and main building, with the craneway between. Finally he would alight on Woodward Avenue beside the power plant and engine house, with a towering water-tank looking down on their roofs. From here a short walk along Woodward Avenue would take him to the main office, where he would be supplied with a guide. Two minutes later he would be entering the main building.

Here, in a tremendous room, almost as light as outdoors, he would find a hive of clangorous noise and bewildering movement; machines whirring, grimy laborers in caps and overalls piling materials, groups standing at benches putting strange contrivances together, leather-gauntleted mechanics handling dangerous-looking levers; live steam spurting in one area, men with oxygen torches brazing metal in another; belts whirling, presses clanging, chutes rumbling, and trains of low-wheeled trucks filled with metal parts moving across the floor. At first all would seem aimless confusion. Then, as the guide shepherded him down the side, shouting information into his ear, he would see that the floor was devoted to machining different segments of the chassis, and that the work was carefully compartmentalized. The great cranes just outside swung piles of iron chassis frames, stacks of castings, and other materials down the craneway, depositing them where wanted. One area was machining camshafts, another beside it crankshafts. Farther along the floor men and machines were busy on the universal joint and the connecting rod. The rear axle, the front axle, the transmission, all had their appropriate sections.

Crossing the craneway, the visitor would find himself in the still more clangorous machine shop, its saw-tooth roof admitting ample overhead light, but nearly the whole expanse a perfect maze of wheels and leather belting. Here were more departments: one for machining cylinders, one for transmission cylinders, one for the cylinder heads, one for pistons, one for brake bands and piston rings, one for differential gears, one for gear-cases. This shop witnessed the assembly of the power-elements: here the motor assembly, there the transmission assembly, in another area the front axle assembly, in still another the rear axle assembly—and finally, the complete combination of all these elements.

Thence the visitor would be conducted to the fourth or top floor of the main building, to which heavy materials were taken by hydraulic lifts. Here he would find departments devoted to the finishing of some large metal segments of the car: fenders, tanks, hoods, and radiators. Here, too, was the upholstery section. On the floor below (the third) the wheels, tires, lamps, floor-boards, and tool kits were made ready, and the body was given paint and trimming. On the next or second floor the body assembly took place. This floor also contained the stock of repair parts and the shipping department. In front, with direct access to the office building, were the experimental department, drafting room, and pattern department.[*]

If Ford took a visitor over the factory, he would show the power-plant with special pride. Rising just beside the office building on Woodward Avenue, it was connected with Henry's own office (he now had a large room, well lighted on two sides, with a handsome desk and fine rugs) by a second-story bridge. The shiny engines supplied the plant with direct current, which had been preferred to alternating for several reasons: Ford had been trained in the Edison tradition and had played a part in the "battle of the systems" waged between Edison and Westinghouse; he regarded a direct-current power plant as simpler and more efficient; and he perhaps foresaw its special adaptability to a moving assembly line.

Throughout Highland Park new machine-tools were constantly coming in. By 1914 the company had about 15,000 machines, all told; each was numbered, identified by a brass tag (one of Edsel Ford's first jobs, when out of school in summer vacations, was to affix these brass tags), and carefully recorded. The policy was to scrap old machines ruthlessly in favor of better types—even if "old" meant only a month's use. Joseph Galamb, as an example, would design a new part. Wandersee would advise him on the kind of steel needed. Then they faced the next question: "What kind of a new forming press do we need to make this part?" Once this was determined, they had to consult

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[*] The very important tool design department here by 1912 had about twenty-five skilled designers and draftsmen under the charge of Carl Emde. They were constantly at work redesigning jigs and fixtures and planning new machine tools or improving old ones, to achieve higher production. New tasks were shoved at them every month: to reduce hand labor, to give the operations more speed, to conserve floor space. "Any problem that would come up," said Emde in 1926, "be it a conveyor or a washer or a furnace or a jig or a fixture or a punch-and-die or gauge, or anything that had to do with making a part, we took care of all the work. Actually it was manufacturing engineering." At this time it also included production layout. (Emde Interview, Additional Tax Case MSS., Accession 96, Ford Archives.)

with Charles Morgana in procurement on the means of getting the press, and the number required. A constant shifting of machines, a constant rearrangement of departments, took place; and as Wibel records, "God help you if you had a particular operation like those Bullard multimatics, and you ran out of room at the end of the line to add enough machines to do your particular schedule!"

At first the executives had expected to retain the Piquette plant for making certain parts and storing stocks of machine tools. However, it was more economical to concentrate the work in one center. In the summer of 1911 the buildings were sold to Walter E. Flanders, acting for the Studebaker Corporation, to become Studebaker Plant No. 10, and the Ford Company threw its best energies into perfecting the Highland Park works. Nearly everybody liked the new site; everybody thought the Kahn-Gray arrangement of buildings and operations a vast improvement. It was easy in the spring of 1910 to bring the average production of cars well above a hundred daily; indeed, the total for April was 3728 machines. For the year closing September 30, 1910, the factory output was little short of 19,000 cars; for the following year it went above 34,500; and for the year 1911–12, it reached 78,440.[14]

3.

As already pointed out, the decision in the Selden patent case, psychologically at least, was like a chisel blow snapping the fetters which had hobbled a large part of the automotive industry. For a decade the Selden pretences and the threats of the A. L. A. M. had intimidated some manufacturers much as Algerine demands for tribute had once frightened Mediterranean shippers. Capital had to some extent been alarmed; some creative talent may have been chilled. No doubt the observer who spoke of Ford's victory in January, 1911, as the end of serfdom, the removal of an Old Man of the Sea, exaggerated the impediment.[15] But that the handicap had been real is proved by a mass of evidence.

At last, declared Norval A. Hawkins, "the Ford Motor Company was placed in a position where it could market its product in the ordinary, customary, and usual manner without the discouragements and intimidations of others. Prior to this time the company's contemplated program of expansion was, upon the advice and counsel of its patent

attorneys, held in abeyance pending the ultimate outcome of the litigation." Hawkins surveyed the whole country with a view to the rapid expansion of marketing, which of course meant the increase of production. He found that in considerable (he said "vast") areas the company had no representative whatever, for the A. L. A. M. had frightened would-be dealers by sending them minatory letters. Sometime earlier, indeed, he had spent six weeks in Iowa making agreements with agents, and in less than a month after he returned to Detroit every dealer had cancelled his contract because of threats.[16] Hawkins's view, thus stated, somewhat exaggerated the facts, but it had a core of truth; and similar statements would have been made by the Velie, Carhartt, Jeffery, and other companies.

The greatest single step in expansion which followed the Selden case decision was the before-noted purchase of the John R. Keim Mills in Buffalo. This plant, owned by a New York jeweler and headed by William H. Smith and John R. Lee, had been active for a time in bicycle manufacturing, had later experimented with a steam automobile, and had finally become one of the foremost makers of pressed steel parts for the automotive industry. The use of pressed and drawn steel had rapidly become vital to car makers. Automobile frames had originally been made of structural steel, or even of wood reinforced by structural steel plates. The pressed steel frame, however, so much stronger in proportion to weight, and so much smoother and sightlier, came into almost exclusive use by 1909. Meanwhile, as large-scale production of cars rose, manufacturers began to show an interest in other pressed steel elements. Rear-axle housings of this material, apparently first introduced by the Fiat Company about 1907, also became popular, and were accompanied or followed by the employment of pressed or drawn steel for brake drums, steering columns, fly wheel covers, and so on.[17] William H. Smith came to Henry Ford for business; showed him the bell housing of an ordinary old-fashioned telephone receiver; and proposed that he make a full-scale axle housing on the same lines. Ford, delighted by the idea of getting this for the Model T, sent Wills and Sorensen to Buffalo. Orders followed. By 1908 the Keim plant was making large quantities of parts for the Ford Company.

Even more important than the Keim products were the Keim executives. In the summer of 1902 there appeared at the plant a tall, thin young fellow of twenty-three, speaking with a marked Danish accent.

He had been a bicycle mechanic in Denmark, and after arriving in New York at twenty had worked in shipyards and the Erie railroad shops. When one of the boys at the Keim plant played a joke on him, he took it in good part. "We will like that long-legged fellow," the lad said. "He didn't get mad at me."[18] William S. Knudsen soon rose to responsibility in the works, but remained ready for any task, however dirty. Once when Sorensen came from Detroit on Ford business, he asked to see the press which was making the axle housings. When the press stopped, out of the pit below it climbed Knudsen, lanky, greasy, and begrimed; he had been controlling operations—and dealing with occasional trouble—from that point.[19] Lee, the general manager, and William H. Smith, the superintendent, were not only capable machine shop directors, but good business men, who travelled widely to find contracts for the plant. A burly Scot with bushy eyebrows, John Findlater, who began as an expert die and tool maker, became a master of pressed steel operations. All four were to play important roles in the Ford Company.

John R. Lee was one of the unusual personalities in an automotive world already distinguished for its many forceful leaders. His was not the persistent, intuitive practicality of Ford, the daring industrial statesmanship of Durant, the ebullient dynamism of Winton, or the blunt, driving, acrid quality of Couzens. He was known as strong, but also as frank, friendly, and fair. He spoke and wrote admirably. "He was . . . a great mediator; he had few if any enemies, and a host of warm friends inside and outside the industry," was to be written of him years later. His virtues were recognized by both Wills and Ford when he came to Detroit, and their effect was to be felt in varying degree by hundreds of thousands of workmen and their families.

From the letting of the Model T contracts, Ford men spent much time in Buffalo. Keim processes were developed on a trial-and-error basis, as an old time employee indicates in describing the manufacture of the rear-axle housing:

> At the start it was drawn tubular-shaped, three inches in diameter and 26.5 inches long. It required nine drawing operations with a number of annealing operations in between. Larger pickling tanks were installed. Because of its length of 26.5 inches in the rough and the shut height of the draw press being 30 inches, it was necessary to devise a method of removing it from the punch after each operation.
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> To overcome this Charlie Morgana, in the engineering department, had

a swinging, horizontal punch made. Sometimes this long, tubular axle housing stuck in the die. Then it was necessary for the operator to get another man to crawl under the body of the draw press and bump it up and out of the die.

When this rear axle housing was through nine operations of the press, it was at that time customary to straighten it with a sledge hammer. It required two men for the operation, and like the crank case and steering column, it had to be welded, if necessary, after being machined and inspected.[20]

All this was intolerable; and Findlater, with the help of several toolmakers, invented a much simpler rear-axle housing called the banjo type, which he sent to the Ford plant for adoption.[21] Cooperation developed along a broad front. Oscar Bornholdt and August Degener made regular inspection trips to Buffalo. Once when a fire broke out Bornholdt began shouting excited orders at the Buffalo firemen—who promptly turned the hose on him!

As the orders of the Ford Company for steel stampings increased, it invested large sums in machinery in the Keim plant. Ford and Couzens, on the recommendation of Sorensen, decided in 1910 to take over the Keim plant, but delayed action pending the Selden decision. Purchase of all the closely-held stock for $574,529 was finally approved June 22, 1911.[22] For a time operations in Buffalo continued without interruption. "We were satisfied as long as William Knudsen, William H. Smith, and John R. Lee were still around," recalls the Buffalo mechanic already quoted. Then just before Labor Day in 1912 a wildcat strike was called by men dissatisfied with piece-work rates on some outside contracts. Knudsen and Smith talked to Ford on the telephone. "That suits me," said Ford. "If the men don't want to work, get some flat cars and move the presses and machinery to Highland Park."[23] Knudsen, much distressed, tried to talk to the strikers, who jeered him. So loyal machinists tore down the presses and other machinery; they were loaded on freight cars; and Knudsen, Smith, and Lee, followed by a gang of mechanics, set off to install them in the Ford plant. Three days after this gang and some Ford millwrights began work, the familiar machines were turning out the familiar crank cases.

This left the Ford Company with large empty buildings on its hands in Buffalo; but that problem was easily solved by turning them into an assembly plant.

The modern machine tools from the Keim works were no more

valuable than the inventive skills of the experienced leaders who came over from Buffalo. W. H. Smith was an engineer of ability; Lee was a capable manager of men, who in time took charge of employee welfare work for Ford. Knudsen refused to come into the Highland Park factory; instead, he directed the opening of assembly plants, which was part of the expansion program, in various western cities. A man of great resourcefulness, driving energy, and stiff independence, he also had a charm or magnetism all his own. He liked to tell how when he came down the gangplank of his ship he loitered to look at the strange New York scene until a harsh voice broke upon his revery: "Hurry up, you blankety blank! Get a move on you!" He had been hurrying ever since, he said.[24] The Ford Company was now in a position to make at Highland Park its own crankcase, axles, housings, and other pressed steel parts—even its own bodies. With the aid of Keim Plant brains, it was able to complete its mass production techniques.

4.

"System, system, system!" exclaimed a reporter for the Detroit *Journal* who was shown round the Highland Park plant as work for the new season began October 3, 1910. By now the original buildings and installations were almost complete. System was absolutely essential if 250 to 300 machines a day, sixty or seventy carloads of Model T's, were to be finished without hitch or vital flaw; but this particular system went beyond old uses of the word. We have seen that at Piquette (as at rival automobile factories) certain elements of mass production had come in: standardization of parts, simplification of product, ever-greater use of machine tools, and a careful arrangement of workers, machines, and materials in sequence to furnish "line production." Fred Diehl, under the watchful eye of Couzens, had systematized the purchase of the mountains of steel, rubber, and other materials needed. At Highland Park two essential elements were now to be added: the continuous motion of work, and careful timing to keep all the moving lines geared at just the right speed. Once they were fully added, mass production had been created.

We shall first describe some improvements in older elements of the system as Highland Park got well under way, and then the advent of new elements.

The first important steps in making a Model T were taken in the

foundry, a great one-story building lying alongside the railway tracks. Down to 1906 few automobile factories in the country had erected their own foundries. As demand for cars rose and manufacturers were hard-pressed to fill their orders, dependence on outside sources for iron and steel castings often became embarrassing. Car makers therefore moved to establish foundries capable of all kinds of work, including the casting of water-jacketed cylinders, formerly imported from Europe.[25] To the Highland Park foundry, the first the Ford Company had possessed and one of the best in the industry, came daily huge quantities of iron, brass, manganese steel, vanadium steel, and other metals. In the early summer of 1911 a really good heat-treating laboratory was completed near at hand and equipped with the best furnaces;[26] a skilled metallurgist, Edward Haines, joined Wandersee in carrying on this branch of the company's work. For a time many parts of the Model T were of vanadium steel: gears, crankshafts, drive shafts, connecting rods, and springs. Already, however, much was being attempted in the heat-treating of steels and the use of tungsten and other alloys—nickel, chromium, and molybdenum—which even before World War I reduced the employment of vanadium.

The most striking product of the foundry was the four-cylinder motor block, a rough casting which weighed 101 pounds. At first in the history of automobile engines separate castings had been made for each cylinder. Then they were cast in pairs. Apparently English manufacturers first devised the casting of the four cylinders in one piece integral with the water jacket, a system which saved labor and materials, reduced the number of fittings needed to fasten the casting in place, and made certain an accurate alignment of cylinders. During 1905 the English innovation aroused much comment in motor journals,[27] and Ford adopted the plan with improvements of his own. The Model T cylinder block was cast in one piece with water jacket; the flywheel and transmission housings were also cast together; the oil pan or lower casing bolted easily to the bottom of the cylinder block; and it was extended to furnish the bottom housing for the transmission, magneto, flywheel, and universal joint.

After careful inspection, the motor blocks and other cast parts were sent to the machine shop to be milled, drilled, and otherwise shaped for their places in the standardized cars. This machine shop had been equipped with the best tools procurable, which were ruthlessly dis-

carded as fast as they could be improved. Some of the elaborate machining instruments were well known both in America and Europe; others had been specially designed by Oscar Bornholdt, and after his departure in April, 1913, by the gifted German technician Carl Emde or (much less frequently) by Harold Wills, William H. Smith, and the Keim engineers. The huge Bliss presses brought from Buffalo pressed crankcases out of sheet steel as a notary's seal presses a design on paper. They were too costly for any company not engaged in continuous quantity production—other manufacturers had to use cast iron; but they cut down the weight of crankcases and car, and soon paid for themselves in reduced expense. For a time they were regarded as one of the unique, or almost unique, features of the factory.

One of the special machines was an improved transmission-testing device for which Emde had first made drawings in March, 1909.[28] Another was a wheel-painting machine which by the summer of 1911 enabled the factory, with half as many hands as other plants would have need for the work, to turn out 2000 automobile wheels a day, painted, varnished, dried, and inspected. It was simplicity itself; seizing six long rows of wheels, it dipped them into a paint vat, rotated them rapidly to throw off surplus paint and distribute the liquid evenly, and deposited them for drying.[29] Not a few automobile works still relied on hand painting. Much more remarkable were a double-end machine tool for pressing tubes in radiator fins; another special machine tool for curling the heads of gasoline tanks two at a time; and a filleting machine for crankshaft hearings. The radiator assembly machine in use by 1913 was also unique. Most radiator makers worked slowly with much hand labor; the Ford Company device made it possible to put together forty-five or fifty tubes and fins (the plates between tubes) in a single operation. Visitors were also shown with vast pride a four-way machine which simultaneously drilled forty-five holes in the cylinder block from four different angles[*]; thus securing greater accuracy in drilling, avoiding the loss of misdrilled castings,

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[*] All the larger automobile factories, of course, paid close attention to special machine tools. The White plant in Cleveland, for one, had boasted in 1917 of its fast, accurate, and largely original mechanisms. "The double milling machine which faces the engine cases," ran the statement of its publicity agent, "once set for this particular duty, will probably cut an entire season's supply before altering its adjustment. Then there is the multiple spindle drill which bores eight holes in the rear axle housing at one operation, the specially devised machine for cutting the burner slots and a multitude of others, each of which performs a special task." (*Automobile*, XVIII, No. 12, Sept. 19, 1907, 401, 402.)

reducing enormously the time used in machining the cylinder block, and saving floor space. The forty-five holes were finished in ninety seconds. Other car makers, using standard machines, had to take the casting out twice to turn it first around and then upside down.[30]

"The Ford machinery was the best in the world, everybody knew it," said John W. Prentiss, a New York investment banker experienced in the valuation of motor industries.[31] "No other manufacturer had sufficient quantity to go into special machinery as Ford did," later testified Alvin Macauley, president of Packard. They were speaking of the situation in 1913. Frederick J. Haynes, who later became chairman of the board of the Dodge Motor Company and who knew the Ford plant well, stated that it had been tooled regardless of cost and represented the greatest advances in the mechanical arts made up to that time. This was the opinion also of Harry M. Jewett, head of the Paige Motor Company, who declared that the equipment of the Ford works was far beyond that of any rival.[32] Some other quantity-production plants were well tooled, but the editor of the *American Machinist,* who spent ten days at Highland Park at the beginning of 1913, found the Ford Company machines unequalled.[33]

Line production, as we have seen, was well developed in various industries and in a number of automobile plants during the first decade of the century. The placing of machines and men in a well-planned sequence of operations to save time, labor, and the stockpiling of materials was too obvious a contribution to efficiency to be neglected. At Highland Park, however, the Ford Company at once carried the principle far beyond any achievement at Piquette, and ere long beyond the point reached by any rival. A sequential line with some curiously original touches was devised in the machine shop; for example, in making the connecting rods a babbiting furnace was placed between machines at just the point needed. Strive as the company might to simplify its car, nearly every part required a surprising number of touches, and these were ranged in time-saving order.

An elaborate sequential line was to be found in the first floor section of the main building where the power-plant of the car was assembled. The motor, transmission, and axles were put together by men each of whom performed a single operation, finding his materials under his hand at just the right moment. The assembly line included the fitting of wheels (ready painted and equipped with tires), springs,

and fender-irons, so that the car began to take recognizable shape. Until the wheels went on, the chassis, placed on the floor or on wooden horses, was stationary, but thereafter it was pushed forward. Stockpiles of parts were placed at appropriate intervals along the floor, and steadily replenished from small trucks; the chassis being shoved from pile to pile. Thus the line moved by jerks, not continuously. As many as three hundred power-plants, wheel-sets, and spring and fender sets were being assembled and tested daily when the *Journal* reporter visited Highland Park in the fall of 1910,[34] and of course processes were rapidly improved.

A third sequential line could be found on the second floor of the main building, where the radiator and other final parts were added to the chassis, and the bodies were fitted on with the aid of a gravity slide. Then the automobiles, the top half of the windshield folded down, the nickeled lamps gleaming, the leather upholstery shining, were driven to the long lines of freight cars on the sidings.

As in the best of the other automobile factories, emphasis was laid on ceaseless experimentation and improvement.* No idea was too bold. The machine for boring forty-five holes at once in the four-cylinder motor-block, designed in Carl Emde's room in 1912, was shown to various machine-tool builders. It was difficult to convince them that it could be made, but finally they mustered enough nerve to undertake it.[35] Late in 1912 the company which supplied Ford with differential housings for the rear axle lost its whole plant by fire. C. H. Wills visited the Ajax Works in New York to improve the machines for making the tubing on the differential housing, and his changes worked so well that the Ford Company saved a dollar each on pieces that were soon manufactured at the rate of about three thousand a day.[36] After that the engineers of the Ford Company, notably Wills and W. H. Smith, worked in close collaboration with Ajax, making many experiments in machine tools.

William Pioch, a machinist who joined Emde's tool design department at Highland Park in the summer of 1912, tells how one urgent problem was solved. "They were getting ready to double their pro-

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* All automobile companies exchanged ideas for machinery; in fact, all manufactories. [illegible] from the [illegible] uld go [illegible] them [illegible] should

duction," he recalls. "A problem came on the universal ball cap to cover the universal joints, turning the radius on the inside. The lathe that they had then was a Leed Apprentice lathe, and the man would take one of those caps, put it on the faceplate of the lathe, and turn four thumbscrews to fasten it there. He would do his machining, loosen the thumb screws, remove the cap, and repeat the operation." This took too long. Moreover, twenty lathes were in use; to double the production forty would be needed—and they had no room for forty. Pioch rose to the occasion. "I designed a job with a special spindle that would take the part and just throw it in there, automatically clamp it, and start the machine." Four of the new devices did the work of forty lathes. What was more, Pioch persuaded the head of the forge department to forge the spindle after Emde had said that this was impossible—it would have to be cast.[27]

5.

Then in 1912-13 came the dawn of production by the continuously moving assembly line. This was the crowning achievement in the creation of mass production techniques. For the Ford Company, the first great step had been taken at Piquette when the management began bringing the work to the men instead of the men to the work. The second step followed, partly at Piquette and more completely at Highland Park, when men, machines, and materials were placed in the sequence of operations. The time was now ripe for the replacement of the jerkily moving line, fed with parts moved up jerkily along the floor, by a continuously moving line fed by overhead conveyors which also moved continuously. Thus far production had been a roadway full of halts and delays, supplied by lanes of equally irregular traffic. Now it became a river, flowing unhaltingly, efficiently forward, and supplied by streams of steady, unresting current.

Countless people, no doubt, confuse mass production with mere quantity production. At the risk of seeming repetitious, we must emphasize again the fact that it is something far more complicated. As Henry Ford wrote, it "is the focussing upon a manufacturing project of the principles of power, accuracy, economy, system, continuity, speed, and repetition." While all these elements are important, special significance attaches to three: accuracy (which includes standardization and the interchangability of parts); continuity (the moving manufac-

turing line or assembly line, to which moving component lines are geared); and speed (which means a carefully timed correlation of manufacture, material handling, and assembly). The great contribution of the Ford Motor Company to technology lay in an expert combination of all these features.

There were kings before Agamemnon. If we peer closely at any great technological innovation, we can see that it had a long antecedent history. All the elements of mass production had been known to man long before the Ford Company so spectacularly and effectively combined them. The ever-greater division of labor had been identified by Adam Smith as a primary factor in eighteenth century industrialization. Oliver Evans, building a completely mechanized grain mill on Red Clay Creek in Pennsylvania in 1784–85, had so designed it that the grain was elevated to the top, went through the processes of cleaning, grinding, and bolting without human assistance, and came out as flour at the bottom.[38] The British Naval Arsenal at Deptford by 1804 had created for large-scale biscuit bakery an assembly line of skilled workers and one kneading machine, which with clockwork regularly turned out seventy ships' biscuits a minute. By 1833 this operation had been almost completely mechanized.[39] As the British improved their tool machinery, J. G. Bodmer in England equipped a machine shop (1839) with the tools arranged in rows according to a careful plan, with small travelling cranes overhead, and with several rail lines traversing the shop to carry materials from one machine tool to another.[40] Doubtless he had British imitators.

A little later, though nobody knows just when, meat-packers in Cincinnati devised an assembly or rather dis-assembly line for slaughtering, dressing, and packing hogs; and these lines came to include overhead trolleys. Shortly after the Civil War the overhead rail systems in these packing houses had grown into conveyor systems, operated chiefly by gravity, with at least an elementary timing of the work processes.[41] So far had they gone on the road to mass-production!

Expert timing was essential to the mass production technique. Forerunners of time study appeared early, among them the English mathematician Charles Babbage, who in his once famous book of 1832, *Time Economy of Machinery and Manufacture,* included tables for the time and cost of each operation in the quantity manufacture of needles.

The effective American innovator, however, was Frederick W. Taylor, father of scientific management, who in 1881 began careful time and motion studies in the machine shop of the Midvale Steel Company.[42] Twelve years later he opened a consulting office in Philadelphia in shop management and manufacturing costs.

Some understanding of Taylor's theory that scientific study of the minutest steps in factory operation would yield data for improving shop arrangements, machine output, and human efficiency, slowly percolated through industry; Flanders in his improved tooling system at Piquette, Hawkins in his departmentalization, and P. E. Martin in his elementary time studies, had doubtless caught some of his ideas.[*] What was not commonly grasped was that infinite care, endless persistence, and large expenditures were required to apply Taylor's principles even to a single department of a plant.[43] Taylor was a leader also in the use of high-speed steel (that is, steel which would maintain a cutting or drilling edge under great stress and heat) in machine tools. Here too the Ford works, employing vanadium and other alloy steels in its machine shop equipment, doubtless owed something to him.

It is perhaps significant that the year in which full use was first made of the Highland Park plant, 1911, was the year in which Taylor published *The Principles of Scientific Management,* and laid before Congress his report on the Taylor system.[44] He twice lectured to engineers in Detroit. In 1909 he made a speech of more than four hours at the Packard plant, deeply impressing the head of the corporation, H. B. Joy, and other officials. Packard at once instituted or accelerated scientific job analyses, and by 1913 the plant had been largely "Taylorized." Late the following year Taylor again visited Detroit, this time addressing more than six hundred superintendents, foremen, and others drawn from industries all over the city. He was told that quite off their own bats, without special prompting or counsel, several Detroit manufacturers had anticipated his ideas.

[*] The Cadillac plant, for example, though manifestly behind the Ford Company, may have owed something to Taylor in arrangements which its heads in 1909 thought specially efficient. "The work of assembling," wrote a visitor to their engine section, "is divided between several gangs, each of which does its own particular work. One group of assemblers scrapes the crank [illegible] assembles the cam [illegible] and bearings, [illegible] water jacket. [illegible] quipment of [illegible] gress, though [illegible] fact that the crank-shaft bearings had to be scraped to fit shows that precision in parts making—as in most factories—was not yet attained.

"This is most interesting," Taylor commented, "as being almost the first instance in which a group of manufacturers had undertaken to install the principles of scientific management without the aid of experts."[45] The machine process, in short, was generating and perfecting its own procedures. Plant engineers and production superintendents, knowing little of theory but schooled in machine shop, foundry, and assembly room to a firm grasp of practical needs, were creating a system of management to meet them. Ford, Wills, Galamb, Emde, and Sorensen may well have learned something from Taylor, but they could also have taught him something.

The idea of continuous motion, as we have seen, was grasped by Ford, Martin, and Sorensen in the final days at Piquette. The first uncertain beginnings at Highland Park can be traced back to 1912; the full growth of the principle began in 1913. As no contemporaneous documentary record of the great innovation exists, we must seek evidence in the recollections of old employees. A machinist named A. M. Wibel, who joined the force in 1912, testified fourteen years later that on his arrival he found conveyor belts in simple form employed in the machine shop, along with work slides, gravity slides for materials being fed to machine tools, and slide tables. An overhead monorail system employing a Sprague electric control had been brought from the Kiem Mills and was in active operation. According to Wibel's interviewer, the engineering expert F. L. Faurote: "Process lines for assembly and finishing were just coming into practise at the time when Mr. Wibel came with the Ford Company. He says the greatest development of these was during 1913 and 1914, but that some of them were unquestionably in concept and in practice prior to March 1, 1913."[46]

This tallies with the recollection of the machinist William Pioch, who began working at Highland Park July 19, 1912. "When I first came to the company," he relates, "they had just put up a conveyor for conveying radiators. I believe that was the first one." He speaks also of gravity slides for materials, which of course went back to Piquette.[47] And we have corrobative evidence from Oscar Bornholdt. He quitted the factory in April, 1913. Before he left, he told an interviewer in 1926, the conveyor system was in operation. "They had a conveyor system for the motor in Building D, and the conveyor system had been worked out in small installations before then. . . . Mr. Bornholdt and all the others were working on the conveyor system, and there

was no doubt at the time he left the factory in April, 1913, that it would certainly be reduced to successful operation in the plant. Before he left, the rotary conveyor was in operation in the foundry."[48]

These continuous conveyor belts to bring materials up to the assembly lines were the work primarily of Ford and Sorensen. Ford insistently demanded greater economies in production, floor space, and manpower. The plant, he said, must increase output and reduce costs. Sorensen, carrying out these directives, installed on the second floor of the main building belt conveyors which took radiator parts, carried them past a bench line of assemblers, and automatically transferred the assemblies to another belt at right angles which passed them under the hands of solderers.[49] When Couzens saw the line he was furious. Sorensen has left a graphic record of the scene:

> It was a very rare occasion when Mr. Couzens came into the plant. One morning he drove into the garage which was between the main building and the office and he asked George, the doorman, who was standing inside the manufacturing building, where Mr. Henry Ford was. At the same time he noticed that overhead these conveyors were carrying the radiators right to the assembly line. He looked up and down the line and apparently he wasn't too pleased and he asked George who put this thing in.
>
> George said, "That is one of Mr. Sorensen's accomplishments." Well, I heard about it later when Mr. Ford picked me up and said, "You'd better be on the lookout for Mr. Couzens. He is on the warpath. It is this radiator conveyor—he doesn't like it. But don't take him too seriously." Half an hour later I had a talk with Couzens, and I took care to take cost figures along.

Scientific management had gone mad, Couzens stormed; the costs would be outrageous. But Sorensen, equal to any fight, had Ford's backing.[50] As soon as the Dane explained the advantages of the innovation, Couzens assented. Other conveyors were soon introduced: one in the fender department, for example, and another running between two long lines of power presses where sheet steel was worked. The most elaborate was in the motor assembling room. Here an endless belt carrier installed close to the roof took motor components, swept them along, and delivered them as wanted through gravity slides to two widely separated lines of motor assemblers.[51] *

* By 1909 the Chalmers-Detroit Motor Company had been making effective use of overhead trolleys. In its factory assembly room, pressed steel frames, the foundation for chassis assembly, were set on stationary rests ranged in two long rows. Motors and other heavy parts were then

Meanwhile, in the foundry a mechanic named Gregory, who had once worked in a brewery which used conveyors to lift grain from storage bins to mash tanks, suggested late in 1912 that a line of moving hoppers be employed to carry mixed core sand to chutes above the mould-maker's bench. When the moulder needed core sand he simply pulled a chain and the material dropped down for his use. A few months later (February, 1913) an endless-chain carrier was installed which ran the moulds under spouts pouring molten metal, and carried them on to an apparatus which shook the hot casting from its blanket of sand. This was the Ford Motor Company's first use of a materials-handling system integrated with a manufacturing process. Obviously, it was a very simple kind of integration, which had in fact previously been developed and patented by the Westinghouse Air Brake Company.

Conveyors, slides, and rollways marked only the beginnings of motion in the factory. The continuously moving assembly line was still to come. Indeed, of the three cardinal elements in mass production—the making of standardized interchangeable parts, machined to close tolerances; the efficient handling of materials; and the installation of a precisely timed, steadily moving assembly line—assembly had been thus far the least developed. Now this third element was rapidly combined with the other two, making a whole far greater than the sum of the parts. The beginning was dramatic. The time was early spring, 1913; the place the third floor section of the main building used for producing magnetos. The director of the experiment was James Purdy, in charge of magneto coil assembly.

6.

"I believe that this was the first moving line ever installed," writes Henry Ford in his reminiscences. "The idea came in a general way from the overhead trolley that the Chicago packers use in dressing

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fetched in on overhead tracks passing between the two rows of frames. At the same time, compartmentalized transfer trucks, each with a sufficient number of smaller parts for the complete assembly of two cars, were rolled by hand from the stock room into the assembly room. The [illegible] itself to two chassis at once, and [illegible] r, until the entire car was [illegible] id other heavy pieces were [illegible] Slauson, "Efficiency System [illegible] This use of an overhead [illegible] works had nothing like a continuously moving assembly line, or even a continuously moving conveyor for chassis elements.

beef."[52] Up to this time one skilled worker had taken a little pile of materials and assembled one flywheel-magneto complete. The average employee in this section finished thirty-five to forty magnetos in a nine-hour day, averaging about twenty minutes to each assembly. Now the assembly was divided into twenty-nine operations performed by twenty-nine men spaced along a moving belt. At once the average assembly time was cut to thirteen minutes ten seconds.

Then in 1914, after the height of the moving trolley had been raised to convenient level, the average time was reduced to seven minutes. Further study of motions and speed brought the time down to five minutes. In short, a continuously moving line and a scientific analysis of action enabled one man to do somewhat more than four had done a few years earlier.[53]

The next step was to adapt the system to the assembly of the motor. William C. Klann, who had joined the company in 1905 and shown his ability to operate machine tools at exceptionally high rates of speed, had now become the foreman of motor assembly. He asked permission this spring of 1913 to try the new plan, and despite an accident on the first day of operations, successfully applied it. He and his superiors, in improving their assembly line, soon took a step of great significance. The crankcase, which was made in the pressed steel department, had until this time been carried to the paint tanks and thence to the motor assembly by a series of laborious steps. A neat conveyor system was designed which picked up the crankcases and carried them through a paint tank and drying oven to the assembly line. When this was done, manufacture, material handling, and assembly had all been coordinated —with results so happy that the example was soon followed elsewhere.

Elated by their success with the magneto and the motor, Ford engineers turned to the transmission. Here, after the conquest of some special difficulties, a successful moving assembly line was brought into operation. Thus, for making three great elements of the car, the factory by the summer of 1913 had three systems of continuous motion. The production of these three systems was so great that it threatened to flood the river of final assembly. Clearly, that also had to be revitalized by the new principles. All the plant executives, no doubt, took part in discussing ways and means; but Clarence W. Avery and Klann gave the subject special attention. Intricate calculations were necessary to determine the best sequence of steps and distribution of parts for assembling the chassis under the improved plan.

That summer of 1913 had brought the usual dull season. Throughout the hot days men in two long lines toiled away, assembling fifty chassis at fifty different spots in each line; a hundred cars in all. The Ford engineers timed them. They found that in August it took 250 assemblers and 80 parts-carriers, working nine hours a day for twenty-six days, to complete 6182 chassis assemblies. Each chassis cost twelve and a half man-hours of labor. That was low average time for motor factories. The management—Ford, Martin, Avery, and Sorensen may all claim credit—installed a motor with a capstan and heavy rope and prepared to keep a line of chassis in continuous motion along the floor.* Six assemblers kept pace with every chassis as it moved. From piles of parts brought up on trucks to the line, they picked out whatever was needed. At the point where the motor was to be installed, a heavy chain-fall with hooks was ready; it swung the motor directly over the frame, and the assembler lowered it into position. This, as Ford says, was a rough experiment; but the average number of man-hours needed to assemble a chassis fell to five hours and fifty minutes![54]

From that moment progress was brisk. Even Couzens could not cavil over the expenditure! The assembly line was soon lengthened to 300 feet, and on December 1, 1913, after careful motion-study, 177 assemblers finished more than 600 chassis—an average of only two hours and thirty-eight minutes of one man's time for a chassis. Hand power on the windlass was replaced by machine power. Before the year ended two assembly lines were in operation; and in January, 1914, four were set in motion—one being driven by an endless chain. As part of the general policy of placing work man-high to save stooping, early in the new year two assembly lines were raised to waist level. At the same time, the management further subdivided the work and increased the crews. The average assembly-time fell to one hour thirty-three minutes. This was success indeed, and the experimentation went on.[55]

Inevitably, in both the magneto assembly and chassis assembly much trial and error were required to establish correct timing and the best

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* Avery and Klann, with the assistance of Peterson, the foreman of final assembly, and Sorensen, first pulled a chassis along the floor to test their ideas. Then after trial and error tests to [illegible] and other technical questions, an assembly line pulled [illegible] a time the method by moving [illegible] 1914, an [illegible] chassis [illegible] working [illegible] Sorensen,

subdivision of work. At first the engineers tried to move the magneto line sixty inches a minute, but this was too fast; they then tried eighteen inches—it was too slow; and finally they settled on forty-four inches.[56] The speed of the chassis-assembly line at the end of 1914 was six feet a minute.[57] Other lines were quickly established: a dash-assembly line, a front-axle-assembly line (with fifteen operations), and a body-and-top assembly line.[58] Everywhere time was saved on an astonishing scale. The best record for stationary chassis assembly had been 728 minutes of one man's work; the best record less than a year later with a moving line and carefully subdivided operations was only 93 minutes.

Of the group interested in the development of moving assembly lines, Clarence W. Avery had the broadest grasp of the subject and showed the most intelligent initiative. Only thirty-one in 1913, this quiet, thoughtful young man had studied at Ferris Institute and the University of Michigan before becoming first teacher and then supervisor of manual training at the Detroit University School, where Edsel was a pupil. Edsel, who not only admired his grasp of mechanical theory and his vision but took a keen liking to him, brought him into the Ford home. Early in 1912 Avery joined the Ford Motor Company, where as Sorensen's assistant he gained a rapid knowledge of machine tools and technological processes. He read widely, knew the latest European and American advances in engineering, and kept in touch with the ideas of men like Frederick W. Taylor. In his fifteen years with the company he was to rise to be foreman, superintendent, and chief development engineer. "Among us all," writes one of the experimental room staff, "he was known as pushing the assembly line." It is clear that the impression given in Ford's *My Life and Work* that the key ideas of mass production percolated from the top of the factory downward is erroneous; rather, seminal ideas moved from the bottom upward. To be sure, Ford took a special interest in the magneto assembly. But elsewhere able employees like Gregory, Klann, and Purdy made important suggestions; Sorensen and others then helped work them out, while Ford gave encouragement and counsel. The largest single role in developing the new system, however, was played by this university-trained thinker so recently brought in from his schoolroom.

"I don't know who thought up the idea of putting the whole car on a moving line," states the experimenter just quoted, Richard Kroll.

"I was given to understand that it was Avery who put that before the boss." Others concur in declaring that Avery first saw the possibility of placing the whole factory on the new basis. It was certainly he who began time-studies on the chassis assembly. Klann relates that after the first experiment with the moving chassis line, Avery said: "Bill, let's start all over, putting on two or three men timing the operations, and have one man turn the windlass crank, and see how fast we are travelling and let's go at it slowly so we will know how many men we will use." And A. M. Wibel testifies in his reminiscences: "As years went by Avery was pretty much the guiding light in working out the sub-assemblies."

Meanwhile, the trucks of parts that had rolled along the chassis-assembly line were being replaced by overhead carriers bringing up the components, or by other modes of transport. Soon the scientifically-timed rivers were all being fed by scientifically-timed tributaries. The whole factory became kinetic. "Every piece of work in the shop moves," wrote Ford in 1922; "it may move on hooks on overhead chains going to assembly in the exact order in which the parts are required; it may travel on a moving platform, or it may go by gravity, but the point is that there is no lifting or trucking of anything other than materials."[59]

Intricately adjusted lines of motion, indeed, reached far outside the factory walls. Precisely the right amounts of coal, iron, nickel, brass, leather, rubber, lubricants, gasoline, and other commodities had to be brought to Highland Park in a hundred ever-flowing rivulets, delivered at just the right time. In the coal fields of West Virginia, the ore bed of the Mesabi, the nickel mines of Canada, men toiled to the end that none of the streams that fed the Ford assembly line, and the imitative lines of other great factories, should slacken. If one tributary ran dry, the whole complex was paralyzed. As long as all the streams ran to the specifications of the engineers, a car came off the assembly line every ten minutes—every five minutes—every two minutes. For nothing but this dynamic system could have met the requirements of the Ford Motor Company as Model T became the most popular vehicle in the history of mankind. The sales rose from 78,440 in 1911–12 to 168,304 in 1912–13, and to 248,307 in 1913–14; and from that point they swept up to 730,041 in 1916–17, or an average of two thousand cars daily throughout the year.[60]

Thus was mass production born—the mass production that Ford gave its classic definition as the focussing of power, accuracy, speed, continuity, and other principles upon the manufacture of a standardized commodity in great quantities.[61] It strode upon the American stage a lusty young giant, a cornucopia of plenty in one hand, a searing flame in the other.

7.

The great boom in automobile manufacturing continued with only transient and unimportant checks until the United States entered the First World War. Year by year new companies were organized, and a few, like the Hudson and the Regal, succeeded. But as the mass-production era dawned, the time had manifestly passed when ill-financed adventurers could lay the foundations of a rich business. Factories now required a huge array of costly equipment, well-established credit, an expertly trained organization in both the shops and the sales department, high managerial skill, and a trustworthy connection with sources of steel, rubber, nickel, and upholstery. Walter E. Flanders sketched in the *Detroit Saturday Night* of January 22, 1910, the transformation that had taken place in the industry since Couzens, Malcomson, and Ford so boldly embarked on their perilous venture:

> The man or concern that would start in the automobile business today must begin, not where others began, but where they are *now*. . . .
>
> For example: To equal in quality cars now selling at $700 to $900, it is not only necessary to build them in tremendous quantities, but to build and equip factories for the economical manufacture of every part. You must begin with an experimental laboratory for analyzing and testing metals. The outlay for this department alone, with its necessary adjunct, the machine shop for tool and jig making, would amount to more than the earlier makers ever had invested in factories. Yet the laboratory is an indispensable adjunct to the modern automobile factory. It is the chief means of effecting an economy that cuts dollars from the final prices of the car.

To enter the field of the medium-priced car with any hope of survival, Flanders estimated, would demand a capital of not less than two millions. The Ford Company and Olds Company had been able in 1903 to buy nearly every part outside, using many simple cast-iron pieces even for difficult work. Now these companies had to have their

own foundries to make cylinders and other castings; their own drop-forge plants to make steel axles, crank shafts, and other vital elements; and their own cold-pressed steel plants for pressing, stamping, and drawing other parts. Many experts believed that room no longer existed for two profits on motors and transmissions, and that a successful motor company could not buy them outside but must make them in its own machine shop.* The great free highroad that had stretched out to success a half dozen years earlier had been blocked, for all the little fellows, by corporations which had built across it plants like Buick's at Flint and Ford's at Highland Park.

"Henceforth," predicted Flanders, "the history of this industry will be the story of a conflict between giants."[62] Already his statement was being verified. That meteoric financial genius, William C. Durant, balked in his efforts to buy out Olds and Ford, and abandoned first by J. P. Morgan Company and then by Benjamin Briscoe, had pressed forward undauntedly with his plan for a huge merger of leading automobile companies; establishing General Motors, as we have seen, with a capitalization of $12,500,000. He still believed in the truth of his audacious statement to a Morgan partner that the time would come when the American people would buy five hundred thousand automobiles every year.

With the Buick, Cadillac, and Oldsmobile as his leading cars, Durant moved so rapidly that at the completion of its first year the combination, hailed as an even lustier industrial infant than United States Steel, demonstrated its self-confidence by declaring (November 15, 1909) a stock dividend of one hundred and fifty per cent.

It soon became evident, to be sure, that General Motors had grown too fast and too recklessly. It had only four dependably profitable components, the Buick, Cadillac, Oakland, and Olds units. A number of its hasty acquisitions, such as the Ewing, Elmore, Cartercar, and Rainier companies, had cost more than they could return. The summer of 1910 fc [illegible] predicament caught in a vi [illegible] borrow [illegible] rageous interest rate of more than seven per cent. Even so, as noted in an earlier chapter, in order to procure this loan the humiliated

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* Actually, it was not necessarily more economic for a company to manufacture its own parts; it might well be more profitable to buy them outside. For the other reasons making for vertical integration, see Ralph C. Epstein, *The Automobile Industry*, 50–53.

Durant was forced to relinquish his leadership, and a banking group took control. Before long, however, General Motors made a sturdy recovery under two distinguished figures in automobile history: Charles W. Nash, chosen president in the autumn of 1912, and Walter P. Chrysler, a Western railroad man by origin who was made works manager. From the moment of its establishment General Motors was the chief rival of the Ford Motor Company.[63] The day of the giants had indeed arrived.

No real exception to the rule of bigness was furnished even by the spectacular rise of the Chevrolet Company. It seemed to begin in a small way, for when it was incorporated in 1911 the designs of the talented automobile engineer Louis Chevrolet were its chief asset. But actually it required a combination of three companies, the Mason Motor Car Company, Little Motor Car Company, and Chevrolet, and a union of the financial genius of Durant, the mechanical gifts of Chevrolet, and the managerial skill of such men as William H. Little, all pooled in 1910–11, to provide a basis of success. By 1914 the Chevrolet Motor Company had emerged to take an important place among the makers of medium-priced cars. At its plant in Flint, run with efficiency and enterprise, it was making a striking success of its Royal Mail roadster and Baby Grand touring car. Durant already had a dream of using it to regain control of General Motors—a dream soon to be realized.* The ability of the Chevrolet enterprise to make about six million dollars in six years grew out of an unusual alliance of plants, skills, and credits in the financial world.[64]

In 1913 Norval Hawkins, speaking to the annual gathering of branch managers, compared the growth of the Ford Company to Aladdin's creations, and furnished some striking illustrations of the scope of its operations. Standing inventory, he said, was kept at seven millions. The supplies needed for the 1913 program of production included 1,000,000 lamps, 800,000 wheels, 800,000 tires, 90,000 tons of steel, the hides of 400,000 cattle for leather upholstery, nearly 2,000,000 square feet of glass for windshields, and 12,000,000 hickory billets for wheel-spokes. To ship the 1913 production (and generally speaking, every Model T made was shipped the day it was completed) would require

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* At least twenty-three [illegible] selling models below a [illegible] land, Hupp- [illegible] al Tax Case

35,000 freight cars. Hawkins spoke of the well-disciplined sales organization, which he thought unexcelled in the world; an army of more than seven thousand dealers, now supplied by forty-six branch agencies as well as the Detroit factory. The force averaged three dealers to every county in the country, and included a remarkable corps of foreign representatives. "We are as well represented in Bangkok, Siam," said Hawkins, "as we are in any city here of similar size."[65] Naturally he mentioned the successful conclusion of the Selden patent suit. The favorable verdict of January, 1911, had been worth "millions and millions" in advertising.

As mass production was fully born in 1913, the Ford Motor Company came to a parting of the ways with the manufacturing facilities of the Dodge Brothers. These hardy veterans of the machine shop had decided by 1912 to achieve independence by building their own automobile. That rough John Dodge, always the more aggressive, was the leader in the undertaking, there can be no doubt. So little dependable material exists upon the two men and their corporate enterprises that it is impossible to fix an exact date for their determination. The fact is clear, however, that friction had repeatedly arisen between the Dodge Brothers and the Ford Company in the annual price negotiations on the transmissions, rear axles, drive shaft assemblies, and drop forgings they supplied. Moreover, the brothers undoubtedly feared that Ford might suddenly cut off their contract and leave them stranded. Of course the Dodges, familiar with the fate of Malcomson, knew that the Ford Company would never tolerate their participation in its management after they embarked in a rival automobile venture.

On August 18, 1913, John Dodge in a letter to Couzens simultaneously abrogated an arrangement made a year earlier for the lease of Dodge facilities to the Ford Company and resigned his positions as director and vice-president. When this letter was read to the directors three days later, Couzens moved its acceptance. Thereupon Couzens was elected vice-president in Dodge's place, and Frank Klingensmith became secretary. "We expect," wrote John Dodge, "to fulfill strictly all the conditions imposed on us by the lease for the ensuing year, and expect your company to do the same. . . ."[66] No note of personal ill-will appears in the letter, in the records of the board of directors, or in any other document of the time. Indeed, the two Dodges, Ford, and Couzens continued to maintain friendly relations. The leasing ar-

rangement of a year earlier had been an experiment, both sides wishing (as Dodge put it) "to do away with the trouble arising annually when prices were agreed upon." It had simply failed to work satisfactorily. The Dodges continued to hold their two thousand shares in the Ford Company—and, indeed, their profits upon this stock did much to support their new automobile venture. They continued for a time to supply transmissions. But after 1913 the two companies drifted apart.

The Ford Company, augmented in skill, mechanical capacity, and other resources by the purchase of the Keim Plant, and rapidly expanding its Highland Park facilities, was in fact now practically self-sufficient. It had not merely developed the most successful of all automobiles, but had inaugurated a new epoch in the industrial history of modern society. Many centuries before, Archimedes, exulting in his invention of the lever, had declared that if he had a fulcrum he could move the world. Mass production furnished the lever and fulcrum which now shifted the globe.

XIX

THE ANATOMY OF SUCCESS

WHEN the largest motorcar show yet held in America opened in Madison Square Garden in January, 1913, the arc lights shone down on more than seven hundred different cars, from runabouts to trucks and buses, their prices ranging from $395 to $7300. One manufacturer, the enterprising White Company, was making twelve different vehicles. Interest was intense. The automobile was plainly undergoing changes in design, engineering, and construction which would immensely enhance its convenience and comfort and enlarge its popularity. Among the new trends visible were the increasing use of the electric self-starter, already found in nearly one-third of the models; the adoption of electricity for headlights and gauge-lights; the slow but steady rise of the six-cylinder engine; and the accentuation of long, low, straight lines in design.

Behind some of these changes lay striking stories. For instance, during the preceding decade engineers had toiled stubbornly to produce a self-starting device. The necessity of cranking the car had been both a nuisance and a peril. In cold weather even the best models might balk for half an hour while the straining driver sweated, the air blue with profanity. Many an unhappy owner, so anxious to start his machine in a hurry that he forgot to retard the spark, went to a hospital with a broken arm. It is said that H. M. Leland's desire to promote a self-starter originated in the fact that an old friend, aiding a woman with her stalled car, was struck on the head by the crank and killed. Various inventors—among them the peppery Scot, Alexander Winton, who devised a pneumatic self-starter about 1907 for his large six-cylinder engine of that year—tried air, spring, or electric devices with scant success. Then, with Leland's encouragement, the young engineer Charles F. Kettering developed a really efficient electric starter;

and the Cadillac came out in 1912 with complete electric equipment. In 1913 nearly fifty other manufacturers provided electric starters. Even the Ford Company some time later equipped cars with it at an extra charge.[1]

The days of oil and acetylene headlights were passing. "Press a button," boasted the Studebaker advertisement of 1913, "and the brilliant electric headlights illuminate the road." Demountable rim-tires were now widely used. Improving upon them, the demountable wire wheel was making its appearance by 1913. Although many manufacturers clung, like the Ford Company, to two speeds forward and one in reverse, four-speed transmissions were gaining ground. Meanwhile, much social history was bound up in the steady adoption of the left-hand drive. As country roads were improved and ditches filled, drivers became more interested in the space between themselves and the vehicles on the left than in the roadside; while as urbanization increased, city traffic and the dangers of alighting from a right-hand seat in the passing traffic made the left-hand drive almost imperative. The general adoption of closed cars, another progressive step of the time, was impossible until more of the rough, rutty highways in town and country were replaced by smooth paving.

The widening acceptance of the car was advertised by young Franklin D. Roosevelt's automobile campaign for the New York Senate in 1912, and by such episodes as President Wilson's use of a Mercer touring car the next year in reaching Princeton to cast his vote.[2] Had ever a human invention been more rapidly improved than the automobile? A decade earlier it had been crudity itself. Edith Wharton in 1903 had made bold to drive fifty miles in Italy with the rich George Meyer, American Ambassador. "The car was probably the most luxurious, and certainly one of the fastest, then procurable; but that meant only a sort of high-perched phaeton without hood or screen, or any protection from the wind." Shaken to the bone, wind-swept, dust-enveloped, they made their trip across the bumpy Campagna and returned exhausted, she to fight laryngitis for days. She made still other journeys, "swaddled in a stifling hood with a mica window," until someone invented a wind-screen. Returning to America, she found cars still worse: "One set out on a ten-mile run with more apprehension than would now attend a journey across Africa." But in 1913 the cars had modern lines, their engines were sturdy, and they gave passengers at

least partial protection from the weather. The period 1900–1910 had seen the secure establishment of the industry. Now the period of 1911–16, as Ralph C. Epstein says in his book on the business, "saw the comparable perfection of its product and the extension of its market to more than the well-to-do classes."[3] The cord tire, the closed body, and four-wheel brakes had all been conceived, and men were working to make them everyday realities.

2.

The new car needed new roads that would match it in modernity, and slowly, painfully, doggedly a growing group of practical idealists had continued the long fight to bring them into being. By 1913, like the Mormons looking down on the promised haven of Salt Lake valley, or emigrants to California viewing the sweep of its central plain from western Sierra slopes, the apostles of modern highways could catch glimpses of their distant goal.

The cause they served had not languished during the preceding decade. Year by year progress had been made. A growing number of states had passed legislation designed to foster better highways, while the federal government had steadily raised the budget of the Office of Public Roads. In 1913 this unit had received an appropriation of $202,120.[4] Meanwhile in 1912 Congress had voted a fund of $500,000 for the improvement of roads that might be useful for rural mail delivery, allotments of this money to become available only if state or local units doubled the amounts furnished by federal authorities. Seventeen states took advantage of this opportunity, a fact which may indicate the number that were doing intensive work in road-building. Altogether about $1,800,000 was expended and 425 miles of surfaced road built.[5]

From 1904 to 1909, reported the Office of Public Roads, the total highway mileage of the nation increased by 48,266.14, and the improved road mileage by 36,950. T[illegible] surfaced roads and its proportion to the total for [illegible] mileage and other types (using [illegible] shells for surfacing) had increased. [illegible] the nation, 8.66 per cent were surfaced in 1909—a gain of 1.52 per cent since 1904. This general trend had continued during the next few years.[6]

Such progress, which may have been more significant than the cold figures show because of increasingly expert supervision of the work, the improved equipment and methods used, and a slight tendency to build wider roads, had been quickened in a number of states by revenues from the taxation of gasoline and motor vehicles. We have seen that in 1904 such moneys amounted to only $33,411; by 1909 they totalled $938,860, had leapt to $5,638,878 in 1912, and were increasing at such a pace that they would reach $25,865,000 in 1916 and $102,546,000 in 1919. Still, in 1913 tax money from motor cars was a promise rather than an actual resource. It was only about five per cent of the funds spent on highways.[7]

Another fact cast a shadow on the accomplishment thus far made: little of the surfaced roadage in the country promised to be satisfactory for motor car traffic. Tests by engineers now demonstrated that water-bound macadam did not stand up under more than seventy-five automobiles a day. It could be made adequate for passenger cars by the use of a bituminous binder; but already the experts were wondering if it would support motor trucks, and soon discovered that it would not.[8] In a few years concrete would be recognized as necessary for an intensively used automobile highway; but before 1913 it had been little employed.

The first concrete surfaces used for traffic had been streets, Bellefontaine, Ohio, having so paved the thoroughfares adjacent to its courthouse in 1891.[9] Wayne County, Michigan, seems to have laid the first mile of concrete country road in America in 1908; Woodward Avenue was thus improved just beyond the Detroit city limits.[10] County officials liked the result so much that they constructed four new miles of concrete highway in 1909, twenty in 1910, and forty in 1911. The year 1912 saw 250 miles built throughout the entire United States, and 500 miles were added in 1913. The increase in succeeding years would be rapid.[11]

One fact was certain: by 1912 a large number of automobile manufacturers and users were conscious of the need for better roads. They had suffered from mud, dust, and sand; they had suffered from a complete lack of roads. Henry B. Joy of the Packard Motor Car Company used to tell how on one of the yearly transcontinental tours that his firm made in the early 1900's he had asked his Omaha dealer about the road west.

"There isn't any," was the reply.

"Then how do I go?"

"Follow me and I'll show you."

They drove west until they were halted by a wire fence at the end of the road. The dealer explained to Joy that he took down this fence, drove on to another, repeated the same process there, and so continued until he met no more fences, when he followed two ruts in the prairie.[12]

Roads changed at county lines from good to bad or vice versa; they changed at state lines. Some were wide enough for only one vehicle; most were unmarked with signs to guide the driver, and unlighted. One group of business men motoring along an Indiana highway found themselves as darkness fell at a forking of three roads, with no idea which to take. A sign on a high pole seemed to promise information. They tossed coins to elect a climber. He worked his way up the pole, managed to light a match, and read: "Chew Battle Ax Plug"![13]

One member of this group was Carl G. Fisher, a prosperous manufacturer who had developed the compression of carbide gas to produce Prest-O-Lite, then still widely used for the headlights of automobiles. Partly as the result of the adventure an idea came to him that proved of strategic importance in the drive for better roads. He himself phrased it: "A road across the United States; let's build it before we're too old to enjoy it!"

In Indianapolis on September 6, 1912, Fisher laid his plan before a group of automotive leaders. He estimated that he needed $10,000,000 from manufacturers of cars and accessories. An organization devoted to the plan could then furnish materials for road construction, which would be undertaken by states and communities supplying their own labor and supervisors and machinery. His idea was hailed with immediate enthusiasm; more than $300,000 was pledged at the dinner where the plan was presented; more pledges came in until about $4,000,000 had been offered. When Fisher refused to direct the project, saying that it must not be identified with any one man, a dozen leaders like Joy, A. Y. Gowen (Lehigh Portland Cement Company), F. A. Seiberling (Goodyear Tire & Rubber Co.), and Roy Chapin (Hudson Motor Car Co.) were quick to take an active role in the work.

Fisher hoped that the Ford Motor Company, then occupying a dominant position in the automotive world, would support his plan. He worked to enlist Ford through Couzens, Senator Albert J. Beveridge,

Edison, Vice-President Charles W. Fairbanks, and Elbert Hubbard. All reported that the Detroiter showed no enthusiasm. Finally Fisher himself went to Detroit, found his man at the pig exhibit of the Detroit Fair, and convinced him that he should join the movement. "Come to my office tomorrow and bring your papers and I'll sign up," promised the creator of Model T.

Fisher gave a quiet dinner in celebration of his victory, but his jubilation was premature. The next morning when he went to keep the appointment, Ford was not at his office, and his secretary said that the manufacturer had changed his mind. Neither he nor the Ford Motor Company ever identified themselves with the highway project, although Edsel Ford later supported it by word and personal gift. Whatever were Henry Ford's reasons for failing to support this particular undertaking, they did not signify an indifference to good roads. From its birth the *Ford Times* advocated better highways, while Ford himself made gifts of land and money to the same cause.

On July 1, 1913, the Lincoln Highway Association was formed with the announced purpose "to produce the establishment of a continuous improved highway from the Atlantic to the Pacific [New York to San Francisco], open to lawful traffic of all description without toll charges." The road was to be known as The Lincoln Highway. In August the plan was presented to the Conference of Governors at Colorado Springs, approved, and in September was offered to the public with a spate of publicity that floated it to popular approval.

The ensuing battle for the highway was protracted and instructive. The Association encountered many difficulties; popular pressure to build it through localities not on the direct route, problems of financing which resulted in the replacement of the projected $10,000,000 fund by a policy of cooperation with communities ready to build sections of the road, the inability of states and communities to act harmoniously, the maintenance of standards in building, and the proper marking of the road.

Eventually the Association concentrated its activities upon educating communities through its field agents and from the central office, upon the building of "seedling miles" (the old "object-lesson" type of activity) for which it furnished cement, the completion of difficult sections with the aid of gifts, and the proper marking of the highway. It educated itself as well as the public. For example, it learned that a ten

foot width was not sufficient, and set a minimum of sixteen and finally in 1918 of eighteen feet. From the beginning it insisted upon concrete as the only proper type of construction, and advocated easy grades. It discovered much about bridges, grade crossings, the treatment of sandy or swampy terrain, and the proper marking of the road with signs. It provided for America a model which crystallized and intensified the sentiment that already existed for extensive and durable road construction.

The road was never completed under its original name. As the federal government took over the task of finishing the highway in 1923, it moved toward the system of numbering its routes, and the Lincoln Highway finally comprised Routes 1, 30, 30N, 30S, 530, 40, and 50. However, the road had done its work.

By 1915, the project was still in the relatively early stages of its growth. So was modern road building in America as a whole. That, indeed, may be dated from the first great appropriation for highways made by Congress in 1916, when $75,000,000 was made available for states that would match the amounts granted in federal aid, and had properly constituted highway departments to handle the road-building projects. The result was the modernization of all state activity, as well as a marked increase in it. Meanwhile the funds being received both by the states and the federal government from licenses on cars (states only), and from taxes on gasoline, vehicles, and parts rapidly rose, reaching $188,970,000 in 1923.[14]

Even by 1915 good roads in any full sense did not exist. But the mileage of highways usable by motor cars was increasing, the automotive industry was recognizing its obligation to help extend that mileage, and the public was becoming aware of the great economic value of the system that was being developed. Men and women generally perceived that a great national road system was just as important to them as a great railroad system. Its full possibilities, which included not only a vital extension of transportation, but a broad social transformation, were still unrecognized by most Americans, although men like Henry Ford had already glimpsed them.

3.

As the Ford Motor Company finished its tenth year, Ford and Couzens could see that they had enjoyed the advantages of a fast-

growing industry. There is a tide in the affairs of corporations as in those of men which, taken at flood, leads on to fortune; and the Company had floated its cockleshell on that swelling wave a decade earlier. At that time the industry, according to government figures, held only seventy-seventh place among the manufacturing activities of the country; in 1914 it took sixth place.[15] Other firms had profited from the rising tide. Cities were growing; farmers were becoming prosperous; and the network of good roads, as we have seen, was steadily expanding. During 1914 nearly a quarter of a billion dollars were spent upon it.[16]

The growth of the Ford company, however, had been notably out of proportion to that of the automotive industry in general. While the national output of cars was rising from 11,000 in 1903 to 485,000 ten years later, the enterprise set on foot by a mechanic, a coal merchant, his clerk, an aged bank president, and a few others had far outstripped all competitors. It had quickly gained and easily held a unique position. As the attorneys employed by James Couzens and others to contest a government tax claim said years later: "The growth had kept pace, not with a single competing company, but with the combined growth of all others."[17] The expansion of Company effort had been particularly remarkable since the introduction of Model T. By 1913 the organization was producing approximately two-fifths of all the cars (exclusive of trucks) made in the United States. Next year the proportion rose to almost half. That is, of all automobiles manufactured, the Ford Company with 13,000 employees produced 260,720, and the 299 other companies, with 66,350 employees, produced 286,770.[18] The proportion was not destined to rise—it would in fact fall. Nevertheless, the growth of Ford's share of the business had been striking:[19]

1908	9.4% of all automobile production	1913	39.6%
1911	20.3%	1914	48 %

The tendency toward concentration in the automobile industry was growing pronounced. The number of manufacturers who enjoyed some real standing when Woodrow Wilson became President was large, careful investigators placing about 120 in that category. But failures were numerous, the difficulty of establishing new factories was increasing, and mergers continued; so that expert observers predicted that the total would fall within twenty years to thirty or forty. In each of the main price-groups one, two, or at most a half-dozen makers

already dominated the field. Four principal areas could be distinguished: the cheap car at $600 or less, the medium-priced car at $635 to $1500, the high-priced car at $1500 to $2500, and the luxury car at $2500 to $7000. In those days, of course, the dollar had a very different value from what it held after two global wars. *Harper's Weekly* in 1913 published an article assuring the "man in the suburbs who has an income of $30 a week and pays $20 a month house rent" that he could afford a car.[20]

In the cheap car field the Ford Company stood practically alone, making 96 per cent of the 185,000 to 190,000 automobiles manufactured. It had lowered its prices drastically in the 1911–12 season, and again in the 1912–13 season. The runabout had gone down first to $590, and then to $525; the touring car to $690, and then to $600. For the ensuing season, 1913–14, prices were reduced again, bringing the runabout to $500, and the touring car to $550.[21] Rival companies, making fewer than 7000 cars in all, might be ignored.[22] Indeed, though Henry Ford always denounced monopoly and extolled competition, in his own area he had now become practically a monopolist.

In the next higher field, that of the $625–$1500 car, two companies, the Willys-Overland with 29 per cent and the Buick with 21.5 per cent, made in 1913 more than half of all the cars sold.* Studebaker was hard on their heels with 21 per cent, while Hupmobile and Reo manufactured 10 and 7.5 per cent respectively; but the rest were nowhere. Reduced to round numbers, Willys-Overland made 35,000 cars in this price range, Buick 26,000, and Studebaker 25,000. R. E. Olds felt it necessary to explain to the public why his Reo Company produced such small quantities. "After twenty-six years, and perhaps a record success, I am building but fifty cars daily," he advertised. "Men ask, why aren't you in the 40,000 class, with all this fame, all this experience, and such a car as Reo the Fifth?" It was not because he lacked orders, he answered. It was because he analyzed all his steel twice, rejected every gear-tooth that failed to stand 75,000 pounds pressure, ground every part over and over for utter exactness, and always used a $75 magneto.[23] It remained true, however, that the $1195 asked for the Reo (with windshield, top, and self-starter) was too high a price for a large market.

In the zone of the $1500–$2500 car, four companies manufactured

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* Buick was of course now, in 1913, a part of General Motors; so were the Cadillac Company, the Olds Motor Works, the Chevrolet factory, and the Fisher Body Company.

more than half of the 62,500 machines sold in 1913. They were the Cadillac with 15,000 or 24 per cent, the Chalmers with 8000 or 13 per cent, the Hudson with 5000, and the Oakland with 4000. Of these companies two, both in Detroit, were recent. The Chalmers Motor Company had been born in 1907, the Hudson in 1909. Roy Chapin's Hudson Company, which had followed the Ford principle of concentrating upon a few models but with slight annual changes in design, had at first emphasized a twenty-horsepower car at $900, but had been forced to raise its price.

As for the most exclusive circle, that of luxury cars selling at $2500 upward, only 18,500 in all were marketed during 1913. Even in wealthy America demand was limited. Six firms made more than half of them: the Packard with 2300 cars, the Pierce-Arrow with 2000, and after them the White, Franklin, Winton, and Locomobile. Many of the buyers were people who could afford chauffeurs, and Packard boldly advertised that its "motor carriage," made for "the critical patron," would satisfy "owner *and* driver."[24]

In the adventurous history of the industry, no other concern had so spectacular a history as the Ford Company, and none had gained so solid a position. On an original cash investment of $28,000, without any subsequent monetary contribution, the founders had erected a business which up to March 1, 1913, had paid dividends of $15,215,000, and had accumulated assets valued at $22,673,500.[25] Its plant was not only the best in the automotive field, but among the best in the entire industrial world. Plans in hand for expanding the factory were expected within two years to double the productive capacity.[26] The whole development had been and was being financed out of profits, without any necessity for borrowing a dollar. Indeed, during the five years preceding March 1, 1913, the company had averaged profits of 118 per cent annually on its tangible investments, and during the year 1912 these profits had exceeded 132 per cent.[27]

Year by year the company had maintained a remarkable financial strength. The balance sheets early in 1913 excited the admiration of Waddill Catchings of Goldman, Sachs & Company. "Marvelous," he exclaimed—"it is a joy to look at them." The demand for the product was too great to be filled, and offered a prospect of indefinite growth. The main problem of the company throughout most of its history, indeed, had not been to sell cars; it had been to manufacture them

in sufficient quantity to satisfy customers. For the calendar year 1912, the company had set a new goal, 75,000 cars; but strive as it might, it could make only 66,000. In 1913 it was ambitious to sell 200,000 cars; but though it again strained every sinew to scale this peak, it could produce only 182,000. The efficiency of its business operation was remarkable even in an industry containing a number of highly efficient units. On every hundred dollars of sales in 1912 the company showed profits of $31.50. The rate of turnover each year (and profits depended on rapid turnover) was so high as to be comparable with retail merchandising; for the fiscal year ending September 30, 1914, sales were 12.74 times the plant inventory—as against a ratio of only 3.67 for General Motors.[28]

4.

The main factors in the extraordinary position which the company held in 1913 require a brief analysis. The Ford organization had emerged from its experimental stage with the development of the Model T. As all leaders of the industry agreed—Macauley, Olds, Haynes, Jewett, Hastings—this car was a remarkably original and efficient engineering achievement. Equally important had been Ford's decision to standardize it with a single chassis for all types, a decision which made possible quantity production on a new scale. And more important still was his decision to push demand to ever-greater levels by lowering prices, so that the touring car which had cost $950 in the fall of 1909 cost only $550 four years later.

The Ford product was self-advertising; every car, as it came into general use, bore the name in bold script, while for that matter its distinctive design made it recognizable a half-mile away. "Our best advertising is free advertising," Ford liked to say. It was subject to no trade risk of substitution or imitation. Every American boy knew by 1913 that a new Ford car was obtainable only from a Ford dealer; and no company was capable of the financial outlay which would be required to manufacture an imitative model. Because of its low price and general utility, financial depressions hardly affected its sale. During the bankers' panic of 1910 the company's business was rapidly expanding, and when the spring of 1913 brought the business depression that Woodrow Wilson attacked as "psychological" in origin, the Model T rolled forward unchecked. The easy interchangeability of its

components made the sale of spare parts and replacement parts a highly profitable segment of the business. As the public knew to its cost, parts for most cars sold at outrageous levels. Locomobile, Winton, or Chalmers could make them only in small lots at something like machine-shop rates; but Ford made them in hundreds of thousands each, and sold them in volume. In 1913 the revenue from parts exceeded $4,800,000.[29] Sometimes Highland Park had to stop car shipments briefly to catch up with parts requirements for machines on the road.

Manufacturing and selling in large quantities, and achieving gross revenues of nearly $42,500,000 in 1912 and nearly $90,000,000 in 1913,[30] the managers were able—as we have seen—to tool the factory with special machines of high efficiency, and to make the other innovations which gave birth to mass production. At the same time, quantity production enabled the company to purchase materials at enormous savings. When Fred Diehl and his assistants bought in one year a million lamps and twelve million hickory billets for wheels, they were able to get high discounts, particularly as they always paid in cash. In 1913 they took the entire output of the American Top Company, the Beaudette Body Company, and the Holley Carburetor Company, with that of other concerns. Such firms became practically subsidiaries. In 1911 the Ford purchases from the Firestone Tire and Rubber Company were more than $880,000, in 1912 above $1,200,000, and in 1913 over $2,000,000. Altogether, the Ford Company computed that in 1913 it obtained an unearned profit of between $1,500,000 and $2,000,000 by taking advantage of cash and quantity discounts.[31]

Obviously, too, the Ford Company could easily persuade suppliers to whom it gave such huge orders to concede priority of delivery. Sometimes it bought for them large quantities of leather, steel, or some other commodity, thus making sure of quality and price, and resold at cost to the supplier.[32] Sometimes it sent its own engineers and experts into a plant to oversee operations. Various companies were able, on the strength of their contracts with Ford, to retool their factories for quantity production. And now and then the maker of some much-needed small part was willing to sell to Ford at cost or below, because he knew that the tremendous market for Ford replacements would give him compensating gains.[33]

The unique sales policy of the company had demonstrated that a systematic lowering of price could go hand in hand with an enlarge-

ment of profits. "Every time I reduce the charge for our car by one dollar, I get a thousand new buyers," said Ford. To take the lower profit on the larger volume was of course an old principle in manufacturing, and thousands of companies in hundreds of industries had proved its validity; but never on the scale of the Ford Company.

For what Ford had proved was that every time the company cut prices it tapped a new layer of demand; that the number of these successive layers was greater than men supposed; and that as they went lower the layers grew bigger. Further price reductions meant new enlargements of the market, and acceleration of mass production's larger economies, and greater aggregate profits. The company's firm grasp of this principle, according to Waddill Catchings, was its unique element of strength, just as failure to grasp it had been one of the weaknesses of rival car-makers. As profits per car had gone down and down, net earnings had gone up and up. Average profit on the car had been no less than $220.11 in 1909–10, the year prices had been temporarily advanced to help pay for the Highland Park plant; by 1913–14, the average profit was only $99.34.[34] But meanwhile the net gains swelled.*

With the $500 runabout and $550 touring car, the company had been strikingly successful in reaching the great rural and semi-rural layers of the population. Farmers, as dealers agreed, studied cars more sagaciously before purchase than any other group, poring over catalogues in the winter evenings and discussing the subject with their wives. Many owned small gasoline engines and knew a good motor when they saw it. They seldom paid more than $1000 for a car; they almost never bought one at second hand; and they cared far more for durability than style. Understanding machinery, knowing how to fight out their own battles, and seldom worrying about a little grease and dirt on their clothes, they were ready to service their own automobiles. The Ford, its engine tough, its body high out of mud and dust, its performance basically dependable if superficially erratic, just suited them. They bought it for many reasons: to keep the boys at home, to get about to see the neighbors, to make business trips, to market produce,

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* Dividend payments reached fabulous proportions, as we shall see; but the company's policy was to maintain large cash surpluses The surplus on hand April 12, 1913. for example, was $7,837,007.14. It was also company policy, as branch assembly plants and branch selling agencies were spread throughout the nation, to deposit its surplus in scores of banks scattered from the Atlantic to the Pacific. Of this, more will be said later.

to save the work-horses. They could easily hitch it to attachments for sawing wood, pumping water, and grinding feed. Once bought, it could be used for years and even decades, becoming almost a member of the family. Nothing pleased Henry Ford more than his following among farmers.

Of all the forces that were breaking down the traditional isolation of farm life, the Ford in these years was [illegible] important as any, even the telephone. Especially did it release multitudes of women from a rural prison. What imperfect statistics we have for the distribution of cars make it plain that farmers, especially in the more prosperous areas, were becoming more and more eager buyers. In 1913 the five north central states (Illinois, Indiana, Ohio, Wisconsin, Minnesota) had one car for every fifty-eight people, which compared surprisingly well with the ratio of one car to every fifty-four people in New England. In the plains states—Kansas, Nebraska, Iowa, Minnesota, the Dakotas—the ratio was one car to every thirty-nine people; this was the highest for any section, and left New York (one car to every sixty-nine people) and Pennsylvania (one to every ninety-six) far in the rear. The South, for evident reasons, had the lowest score of all in car-buying, Mississippi possessing but one car for every 580 people and Alabama but one for every 403. California made the best showing of all; one to twenty-nine, if various guesses were accepted, for California had no registration.

Plainly, certain correlations could be worked out between car-ownership and per capita wealth, and between cars and distances. Experts agreed in 1913 that farm areas still offered the broadest field for selling cars. Although urban demand was lively, reported two investigators for the Curtis Publishing Company, "the largest gains in the future are likely to be in the rural districts."[25] That was the market which the Ford Company had done most to reach. Because of its practical monopoly and high expectations for the future, the company took no interest whatever in the Underwood Tariff of 1913 and its reduction of the duty on complete automobiles valued at less than $2000, from forty-five per cent to thirty per cent ad valorem.

5.

One other element in the company's success lay in the youth, vigor, and ambition of its management. Ford, now fifty, was the oldest of

its leaders. Couzens, Wills, Martin, Hawkins, Emde, Sorensen, Diehl, John R. Lee, and W. H. Smith were all comparatively young men. As yet, control rested with a group; it was oligarchical, not dictatorial. The sheer impetus of the company's growth, its exhilarating prosperity, and the fact that Ford was fully occupied with engineering and design, and Couzens with business affairs, made for a real if precarious harmony. "It was still, at that time, a stock company, with a board of directors," one observer notes, "and while Mr. Ford was the largest stockholder, and largely shaped policy, nevertheless, the board of directors had to be considered." Actually the board of directors counted for much less than a compact group of executives. Couzens, Klingensmith, Wills, and Martin were specially influential, while young Sorensen had increasing authority, and Hawkins possessed too much ability to be ignored. All these men, like Ford, believed in energetic expansion. "The basis for interdepartmental friction," states this observer, "was the usual jockeying for position in something that was growing pretty rapidly"[36]—but this was not serious.

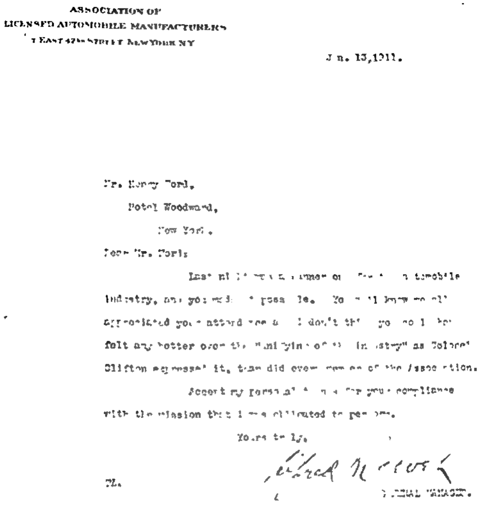
That Ford's word was final in all manufacturing matters, and Couzens' in nearly all ordinary business affairs, was evident to their subordinates. Max Wollering, a man of keen intelligence and ample opportunities for observation, was impressed—like practically everyone else—by Ford's quality of vision; by the imaginative foresight which divined the needs of plain Americans, and the engineering skill which devised means of meeting them. The guiding brains of the entire institution were Henry Ford's, declared Wollering. "He was the one who made the decisions." Men in the business offices, however, like George Brown, naturally regarded Couzens as the dominant power. "Whatever was to go on had to pass him." Inevitably, the two strong-willed leaders occasionally came into conflict. The Hungarian-born engineer Joseph Galamb noticed after 1909 that "a little friction" between the two heads was visible "all the time."[37] This was doubtless slight; neither minute books nor the reminiscences of pioneers record any real quarrels; but their collisions would have been graver if they had not occupied entirely different spheres.

In general, it could be said that Ford was widely liked, Couzens widely disliked—though these generalizations had conspicuous exceptions. Both were hard-working men, devoid of any undue sense of personal importance, and intensely earnest. Ford was much the more

democratic and affable in demeanor; he never forgot that he had been a wage-earning mechanic, he did not lose his temper like Couzens, and when he let his "mean streak" find free play, he usually acted through some agent. When H. L. Arnold and F. L. Faurote spent many months in the Highland Park plant preparing their book on its methods, they formed the impression that Ford met his factory heads (though no longer the mechanics) on terms of cordial and even deferential comradeship. He had a ready smile and cracked frequent jokes; he particularly liked young men; he underrated his own abilities.[38] His passion for machinery of all kinds, his taste for outdoor pursuits and country life, his aversion to clubs, theatres, and social gatherings, and his positive hatred of public appearances, made him seem one of the boys.

"Mr. Ford's office," reported the *Detroit Saturday Night* just before he left the Piquette plant, "would never remind one of those elegantly furnished headquarters generally ascribed to men of his position. You will find it on the other side of a little obscure door in a corner of the second floor of the factory. He has a little four by six flat desk, and no armchair. In addition, there is a mammoth blackboard, a drafting table, a turret lathe, and several hundred patterns, castings, and samples. It is a workshop, not an office, and is typical of the busy life of the man who has revolutionized automobile conditions the world over. It opens into the tool room, and one is more apt to find him outside busy on some special tool than inside. . . ."[39] The journal added that Ford never drank or smoked, used no coarse language, and had not worn a dress suit half a dozen times in his life. He could or would not make a speech. At home, where he had a complete workshop, he could often be found at his lathe. When he removed to Highland Park, he had a large and handsomely-furnished office overlooking Woodward Avenue in front and the power plant—his special pride—at the side; but he still spent most of his time in the shops or in the experimental and designing rooms.

By 1912 Ford had purchased about 3700 acres in Dearborn Township, his holdings almost surrounding the little village he had known so well in boyhood. When he had first begun buying property there, many citizens naturally entertained visions of a great factory. Why else should he acquire so much land, a single tract embracing 1700 acres? A farmer, it was said, had been paid $1000 an acre for a small



ASSOCIATION OF
LICENSED AUTOMOBILE MANUFACTURERS
7 EAST 42nd STREET NEW YORK N.Y.

Jan. 13, 1911.

Mr. Henry Ford,
Hotel Woodward,
New York.

Dear Mr. Ford:

Last night was a banner one for the automobile industry, and you made it possible. You will know we all appreciated your attendance and I don't think you could have felt any better over the "unifying of the industry" as Colonel Clifton expressed it, than did every member of the Association.

Accept my personal [illegible] for your compliance with the mission that I was allotted to perform.

Yours truly,

Alfred Reeves

General Manager.

TL.

Letter of Alfred Reeves to Henry Ford written the day after the A. L. A. M banquet

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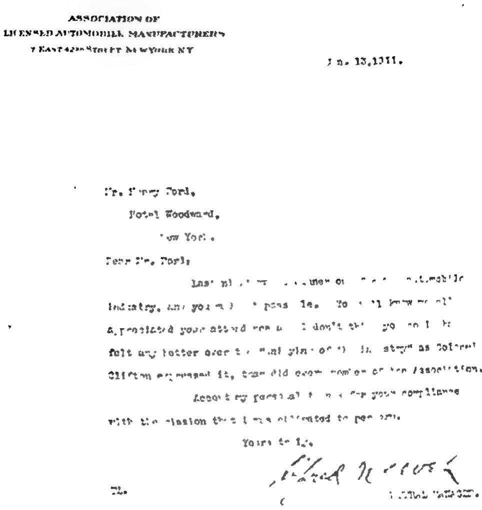

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Accept my personal thanks for your compliance with the mission that I was delegated to perform.

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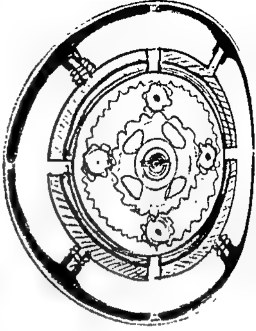
Alfred Reeves

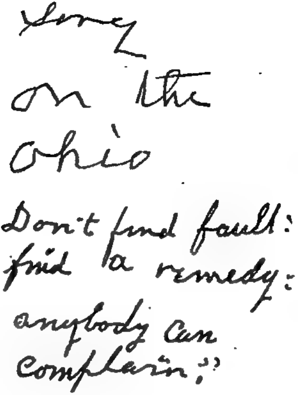
TL.

ALFRED REEVES.

Letter of Alfred Reeves to Henry Ford written the day after the A. L. A. M. banquet

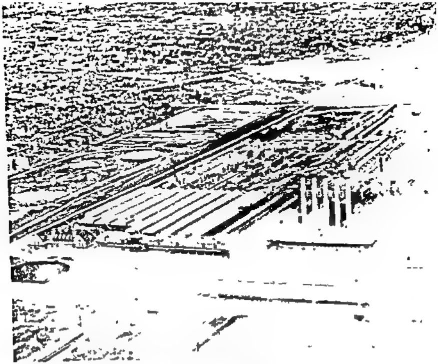


Design for the magneto assembly (possibly by Henry Ford) and (right) a typical jotting from one of Ford's "diaries"



Sorry
on the
Ohio
Don't find fault:
find a remedy:
anybody can
complain.

A Model T in 1914, showing the machine in the time of its first maturity

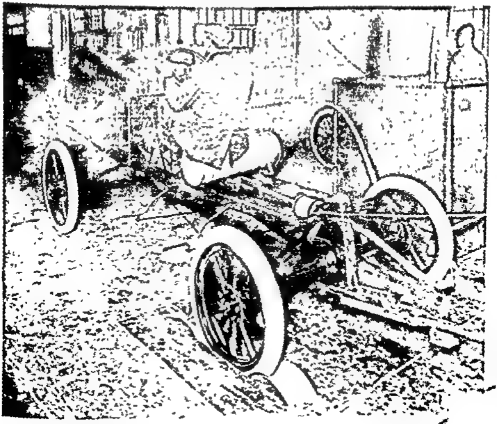


Clarence W. Avery

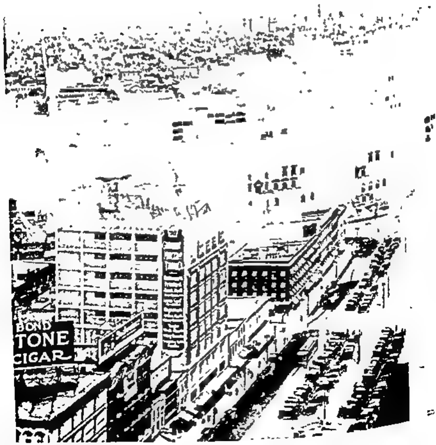
The Highland Park Factory

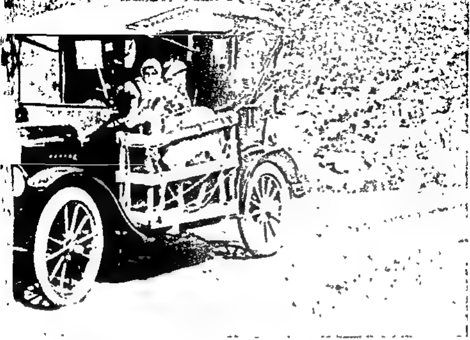
Power plant with five tall stacks in the foreground; office building immediately to the right of the power plant, rail connections visible to the rear and on the left. Note at the rear of the power house the transverse craneways and the sawtooth-roofed machine shop.

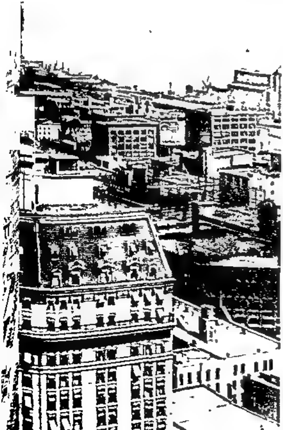
Starting the engine as the chassis leaves the assembly line, Model T, Highland Park Plant, 1914 or 1915



Rural uses of the Ford car; transporting livestock







Detroit from the Dime Bank Building—a view up-river (about 1916)

Part of motor assembly, Highland Park Plant, 1913 or 1914

parcel to round out one holding, with a bonus for his prompt evacuation. But as Ford made no move toward a new factory, reports arose that he intended merely the creation of a large bird reservation. He took a keen interest in wild life, and among the few volumes he read —engines and machinery were his real library—those on natural history held a prominent place.

This taste led him to one of the warmest friendships of his life. "I had a surprising letter," wrote John Burroughs to Clara Barrus on December 6, 1912. "Mr. Ford, of automobile fame, is a great admirer of my books—says there are few persons in the world who have given him the pleasure I have. He wants to do something for me—he wants to present me with an automobile all complete, and send a man to teach Julian how to run it. His sole motive is his admiration for me and my work—there shall be no publicity in connection with it." Burroughs was soon driving the Ford about his Hudson Valley farm; driving it one day through the end of his barn and almost into eternity. "The blind, desperate thing still scares me," he wrote in May. Next month he was in Detroit visiting Ford. "His interest in birds is keen and his knowledge considerable," commented the naturalist. "A lovable man."[40]

Couzens, efficient as ever in organization and administration, with a constructive grasp of marketing and finance, showed little of Ford's capacity for devolving responsibility on others. Hard as Ford worked, he seldom had any fixed duties; he could walk about the plant, tinker with Wills and Emde over experimental design, visit the heat-treating laboratory, or work at his farm on his tractor plans, as he pleased. Couzens, driving himself hard, drove others harder; associates picture him as inflexibly honest, charitable, and public-spirited, but also exacting, passionate, and domineering. "A little bit harsh with everybody and he was very strict," recalls Joseph Galamb. "He wanted everything done the way he liked it."[41] Once Ford sent his trusted helper C. J. Smith to carry out a company job in Piqua, Ohio. When Smith turned in his account, Couzens testily questioned the charge for a hotel room. "Did you stay in the bridal chamber?" he asked sarcastically. But Ford, hearing of the incident, reassured Smith. "Don't pay any attention to him. When you go any place, you take the best they've got."[42]

Indeed, one of Ford's traits was his dislike of any tendency to value

money for itself. It was useful not to save, but to spend—constructively. "I was warned right when I started," recalls George Brown, who worked in the accounting department, "never to mention the cost of anything, or money, or finances, to him. If you did, you'd get . . . a kick in the pants or a punch between the shoulders."[43] This might have seemed natural after the flow of millions began, but it was true also in the early years of limited returns and uncertain prospects.

To Couzens, however, every penny counted. From Diehl, in charge of purchasing, from Klingensmith, responsible for accounts, from John R. Lee, who oversaw personnel, and from Hawkins, who controlled sales, he expected meticulous reports. "He took too much interest in the details down the line," runs the verdict of R. T. Walker. In 1912-13 a Chicago advertising man named Glen Buck assisted Ford in promoting the passage by Congress of the Weekes-McLean Migratory Birds Bill, and then served briefly as advertising manager of the Ford Motor Company. "When I resigned my position last October," he related, "I went into the office of Mr. James Couzens, the vice-president, and stated to him that I had several thousand dollars coming to me as bonus, and said as I was to leave their employ I wished they would kindly give me a check for the full amount. Mr. Couzens simply stated, 'We do not give bonuses to people who resign or leave our employ, so consequently, Mr. Buck, you have nothing coming.'" Buck had an undefined grievance against Ford, whom he accused of making other people his tools; but it was Couzens's curt dismissal (though Couzens may well have been in the right) that rankled most painfully.[44]

The other executives made an able group. As plant superintendent, P. E. Martin, a well-trained man, though not the equal of Flanders or Knudsen, was a strict disciplinarian, often harsh, but seldom unfair. One day a foreman, to punish an expert toolmaker for a mistake, put the man to mopping the floor. Martin saw the mechanic wielding his mop, and asked the reason. The hand explained. At once Martin discharged the foreman. "To set a highly paid toolmaker to doing a laborer's job was bad enough," he said. "But worse than that, it was humiliating to a good man." The high labor turnover that developed under Martin in 1911-13 indicates that his rough methods were resented. Norval Hawkins, who did so much to systematize the Ford management, was brilliant and incisive. Some thought that his rela-

tions with dealers and branches were a bit sharp, and he was never loved by men in the field. Sharp antagonism eventually arose between him and the jovial New York branch manager, Gaston Plantiff, who held an exceptional position, entertaining men from the home office and abroad, and doing a good deal for public relations.[45] The indefatigable Frank Klingensmith—"Kling"—was something more than what Lord Perry later called him, an excellent bookkeeper. Diehl was highly competent, while John R. Lee showed the remarkable gift for handling personnel which he had developed in Buffalo.

Arnold and Faurote in their description of the Ford plant emphasize the efficiency of the elaborate business organization which Couzens, aided by Norval Hawkins, built up. An analysis of the management of the vital function of purchasing raw materials and parts will serve to illustrate the system which prevailed.

The business department based its orders for materials upon estimates of production volume made at the beginning of the year, and upon a continuous inventory of components on hand at Highland Park and in the branch assembly plants. The company usually made contracts not for an entire season's needs, but in installments, following the movements of the market. Once Diehl placed an order, he turned the particulars over to a follow-up assistant who watched it assiduously until the factory or foundry sent word that the materials were shipped. As soon as bills of lading, car numbers, and routing details arrived, they were dispatched to the traffic department, which exercised control until the goods reached the unloading platform. The merchandise then passed under custody of the materials department, which saw it transferred to the exact point of use in the factory. Shop sections were plainly identified by letters and numbers painted on columns and girders, so that even an illiterate foreigner could guide parts to the proper place. If too much stock accumulated anywhere, the routing clerk designated a new delivery-point. Purchase orders so far as possible provided for delivery of goods in standard packages of precisely-counted contents, facilitating the taking of inventory. All materials, as they passed from department to department, were strictly charged and credited on carefully-designed forms.[46]

The main strengths and weaknesses of the company administration in 1913, it will be seen, centered in Ford and Couzens. They had provided the inspirations which made it great, and both manifested in

growing degree the dictatorial and temperamental qualities which would soon mar and eventually impair its greatness. So long as one balanced the other, and John F. Dodge and others exercised considerable influence, the possibilities of harm to the company were limited. Unfortunately, after the ousting of Malcomson, Ford could at any time have taken absolute control. Arnold and Faurote, in a passage on his traits which they meant to be flattering, included facts which could be read in the opposite sense:

> So far as a close observer can discover, Ford . . . acts wholly upon inspiration. In reply to a direct question he disclaimed any systematic theory of organization or administration, or any dependence upon scientific management, and seemed to lay emphasis wholly upon the personal equation. At he put it, "I know what kind of help I want and I look around until I find the man I am sure will give it." He has thus built up about himself not so much an organization as a staff of aides—all ranking as equals, none in command of any one department, all ranking any titular head, each eager both to meet any suggestion Ford advances or to volunteer suggestions for his decision, each as likely as the other to be put in charge of any shop-betterment idea Ford may conceive, because he observes no discrimination in lines of service. This alone makes the Ford establishment unusual, to say the least, in its direction. It also makes the establishment his own throughout, though, as he said, leisurely looking out of his office window, "I have no job here—nothing to do."[47]

"It . . . makes the establishment his own throughout"—this is the definition of a despotism; and although despotisms can be magnificently effective for short periods, in the long run industrial despotisms no less than political despotisms operate badly.

6.

As Model T brought in a swelling stream of revenue, the program of expansion for the Ford Motor Company became impressive in size. Early in 1912 the stockholders and directors agreed to appropriate fifteen per cent of each year's profit to increasing their productive resources. What this meant can be gathered from the report which Frank Klingensmith made in 1916. The fifteen per cent from October 1, 1912, to December 1, 1915, he declared, came to $16,321,274.25. Of this, approximately $13,000,000 went into a program for erecting branch assembling plants throughout the country, and most of the rest into

expansion at Highland Park. Not content with using these sums, Ford wished—to the great irritation of the Dodge brothers—to restrict dividends and conserve most of the remaining profits for future growth.

When the resolution of April, 1912, was voted, branch assemblies already existed in Kansas City and Long Island City, while, as we have seen, the Keim Works in Buffalo were converted into a branch. This assembly plant system was then peculiar to Ford. No other automobile works had a sufficiently large output to make regional branches economic. It was only after the First World War that the Chevrolet Company established half a dozen such plants. For the Ford Company, however, their establishment offered many advantages. By shipping parts in a knocked-down state, it was able to load the components of twenty-six Model T's into an ordinary freight car instead of the three or four complete cars that could otherwise be sent. (Norval Hawkins, it will be recalled, had developed the techniques of this process.) At the same time, it obtained a lower freight rate. Railroads then charged ten per cent above first-class tariffs for an assembled automobile; while for the use of a thirty-six-foot freight car, costs had to be paid on 10,000 pounds whether that amount was loaded or not. Most manufacturers, shipping only three automobiles to the car, were able to load only 6,000 pounds. They lost the freight on two tons. But the Ford Company, loading its cars to capacity, paid for actual weight only, at rates varying from first to sixth class. This meant a saving of about one-half in costs. As the bill sent to the automobile buyer was f. o. b. Detroit, it included an amount equal to freight charges under the *old* mode of shipment. Moreover, many parts could be shipped directly from scattered factories to neighboring assembly plants; say from Chicago to Kansas City, or Rochester to Buffalo.

Shipping parts in this manner relieved the congestion at Highland Park, reduced loading costs, and made possible the use of narrow-door freight cars. The railroads, which suffered from periodic car shortages, were pleased. Every branch assembly plant was also an asset in public relations. People in Oregon liked to see a factory rising in Portland, and Texans to hear of one in Dallas; the press responded with favorable articles; the payroll delighted employees, banks, merchants, and politicians. And of course branch factories could distribute cars more expeditiously and efficiently than Detroit.[48]

Near the end of 1911 Couzens had been authorized to tour the

Pacific Coast, explore the opportunities in that fast-growing region, and if he wished, lease or purchase properties needed for assembly plants, branch marketing agencies, and warehouses. He returned brimful of enthusiasm. Cars could be sold in tremendous quantities out there, he believed—and he had already taken sites for assemblies in Los Angeles, San Francisco, and those two jealous neighbors, Seattle and Portland. Immediately after the policy decision of May 1, 1912, plans were taken in hand for four assemblies on the Pacific; one in the mountain zone at Denver; five more in the Mississippi Valley—Minneapolis, St. Paul, St. Louis, Chicago, Memphis; and two in the East, at Boston and Philadelphia. Meanwhile, the Kansas City and Long Island City plants were enlarged. Before the outbreak of the European War, all these assemblies were realities—and so were others at Dallas, Houston, and Columbus, Ohio.

The talents of the tall, keen-eyed, tough-minded Dane, William S. Knudsen, were useful in creating these new outposts. Remaining in Buffalo after the purchase of the Keim Mills to install the new assembly there, he had been called to Detroit in the summer of 1913. For several months he helped place and test machinery, carefully avoiding any entanglement with manufacturing, for he distrusted Martin and Sorensen. "I was afraid that as a stranger I might not get fair treatment,"[49] he said later. It appears that when the Keim works were making axle housings and other stampings for Ford, Martin and Sorensen had repeatedly sent over designs which he thought impractical and therefore altered—with resulting friction. Knudsen always maintained a strong personal independence, and a stubborn belief in his own practical experience. He once visited the Edison Laboratories, saw countless cubbyholes stuffed with paper, and asked the man in charge what they were. "These," said the superintendent, "are records of 999 things we have learned by experiment not to do." It should be added that Henry Ford, while respecting Knudsen's abilities, never really liked the man—for he objected to some of his personal habits.[50]

In October, 1913, Knudsen was sent into the field to oversee the work of getting the new assembly plants into working order. First he went to the addition in Long Island City, then to Chicago, then to Memphis, then to Denver, and finally to the Pacific Coast. He found that the average drive-away radius for delivering cars, as yet only about a hundred miles, was rapidly being enlarged by the construction of better roads. He was impressed, too, by the fact that nowhere did

the Model T have any real competition in its price-field. Making almost nine-tenths of all automobiles sold below $750, the Ford Motor Company could laugh at rivals.

"The Brush was the first car which endeavored to give Ford any competition," Knudsen later commented, "but it failed. Then came the little Saxon, which was making great headway, but Chalmers got caught in the six-cylinder race, which wrecked this company. Then came the Overland and the Chevrolet about 1913 or 1914. The first Chevrolet was manufactured by Durant to match the Ford, but Durant did not know how."[51]

Knudsen thought highly of Wills, with whom he had worked in both Buffalo and Detroit; a designer of great fertility in developing special machinery, he thought, and a generous man in giving credit to those working under him. The Dane was impressed most of all, however, by Henry Ford. In his spontaneous statement of 1926 he spoke of Ford's "tremendous" foresight, originality, native shrewdness, clarity of thought, and temerity in courses of action from which ordinary people would recoil. "I learned an awful lot from him," said Knudsen. Ford was courageous in his pacifism, his social ideas, his labor policies. Most of all, he was resolute in applying the foundation principles of mass production: simplicity of design, speed and continuity of quantity production, huge sales at ever-dropping prices, and small unit profits.

Knudsen found that his courage was allied, however, with a certain personal timidity; he shrank from public appearances, refused to make a speech, and avoided a clash of wits in fields where he was uncertain. This timidity, Knudsen concluded, required a compensation which he found in self-advertising. Like Napoleon, Ford saw that the public liked to simplify sweeping movements, based on ideas and innovations from many sources, by attributing them to a single man, who got all the praise and blame. Ford was quite willing to become the popular embodiment of the mass production movement; he wished to create a Ford legend. But because he had no faculty for reaching the masses by personal appearances, he had to fall back upon newspaper and magazine publicity, which Knudsen thought he found specially gratifying. He had "a very keen sense of advertising."[52] Withal, he was a many-sided, gifted, and unpredictable man; fascinating in his mixture of extraordinary strengths and unexpected limitations.

While the branch assemblies were going up, Highland Park was

being completed. The total investment for buildings, tanks, and fixtures reached $3,575,000 on February 10, 1914, to which had to be added $2,800,000 for machine-tool equipment. And the year 1915 found large buildings already under erection on both sides of the railroad tracks, to be served by a travelling crane which would unload freight cars to any of seventeen different landings. Highland Park not only was the best automobile plant in the world, but continued to hold that place until after the war. It maintained the primacy which Karl Neumaier, general manager of the Benz factory at Mannheim, gave it when he visited American establishments in the winter of 1910-11. "The Ford plant," he told the Detroit *Journal,* "is the most remarkable in the world; it is the very best in equipment and method."[53]

7.

Mass production techniques were meanwhile being systematically developed, so that by the spring of 1914 they held partial possession of the factory. Highland Park had then reached a capacity of 1200 automobiles a day. Four great principles had been applied throughout: the use of the latest machinery of original design; the placing of men and machines in operation sequence; the employment of work slides and moving assembly lines; and the installation of overhead carriers to bring up materials. The period for assembling a motor, which only the previous fall had been about 600 minutes of one man's time, had been lowered to 226 minutes. The period for assembling a chassis had been reduced from 12 hours 28 minutes of one man's time to the 1 hour and 33 minutes already mentioned.[54]

A large force was constantly employed in what might be called the creative preparations for mass production; that is, in equipping the factory to carry it on. This spring of 1914 saw fifty-nine men hunched over desks with triangles, compasses, and slide-rules, making drawings for machine tools and fixtures; forty men busy with hammer, saw, and chisel making patterns; and nearly five hundred men at Highland Park and three hundred in outside machine shops forging, casting, and building tools. A regiment of men, in short, was constantly storming the bastions of old-style factory methods. While this work was proceeding on installations supposedly new, the Ford shops were continuously moving and replacing more than five hundred old machine tools to facilitate "progressive production;" that is, [illegible] improve

work sequence and save labor. Two investigators who made a study of Highland Park this spring pointed out that the factory had arrived by practical trial and error at the precise results expounded in two new books on theory, E. C. Jones's *The Business Administrator* and C. E. Knoppel's *Installing Efficiency Methods*.

Go into Highland Park on a June day in 1914; pick out one of the simpler operations, the assembly of the front axle; take up a place alongside the grim-faced man in shirt-sleeves, but with collar and tie, bossing the work. What would you see? A chain-driven assembly line, looking like a broad chute, encased in smooth sheet metal, moving slowly but inexorably forward; a series of axles, perhaps six feet apart, fastened securely to the chute; a continuous metal trough running down its center, containing small components; on each side of the chute, intent workmen, most of them young and foreign looking, doing just one job each to the axle which slowly moves toward them and then slowly recedes.

You ask the boss, "How many operations?" If you have thought of the axle as a simple part, you are astonished by his reply, "Fifteen." Sure enough, you see men whose function is to join parts together and insert a bolt; others who put nuts on the bolts; others who tighten the bolts and insert cotter pins; one who uses a hand-lever arbor press to impose the inside ball-bearing cone upon the stub-axle; and another who applies a more complicated machine to bring steering-arms and stub-axles into combination. The boss will tell you that each different component of the axle represents an elaborate amount of machine work. For example, the stub-axle connecting-rod yoke has undergone eleven different drillings, filings, reamings, millings, countersinkings, and the like in eight different machine tools before it reaches the assembly line. The boss will also inform you that everybody is constantly studying a further simplification of assembly line procedure. Thus the job of joining the steering-arm with the stub-axle was once performed in three operations; the new machine does it in one.

Shop workers used to have a saying: "Everybody takes the hardest way first." That had assuredly been true of automobile manufacture. Sometimes a simple improvement made an astonishing difference—once people thought of it. Who would have believed that changing the height of work in relation to the worker would add so much to efficiency? Who would have thought in the old Piquette days, when

a stationary knot of men put a motor together, that the division of that job into eighty-four different operations would enormously increase the speed of the shop? Shifting a Foote-Burt valve-grinding machine from its old place on the floor into the assembly line saved the work of two men. Similarly, the introduction of two or three new men at one point might displace a dozen elsewhere. The assembling of piston and rod, for example, was a simple three-minute operation for one man: push pin out of piston, oil pin, slip rod into place, thrust pin through rod and piston, tighten screw in end of rod, and place and open the split-pins in the pinching screw. At first nobody made a careful study of the way the three minutes were expended. Then the foreman of motor assembly conducted a stop-watch analysis.

"Why, those bench men on piston-and-rod spend four-ninths of their time taking needless steps," he announced.

When this particular job was divided into three parts for three men, 14 of the 28 hands assigned to it could be dismissed. The superintendent was at first incredulous. Then he was vexed that nobody had thought of the change before.

Motor assembly, as we have said, had been divided into 84 different operations performed in the spring of 1914 by nearly 500 men in several continuously-moving lines. Chassis assembly, the most spectacular feature of the factory, had been divided into 45 operations. While 1000 motors were being assembled in an average day at Highland Park, only 600 chassis assemblies had to be made, the other 400 taking place at the various branches. Eighteen men and two presses employed on feeder lines sufficed to affix mud guard brackets and rear springs to 600 chassis frames a day. Then the work was transferred to three chain-driven lines, each employing 64 or 65 men; a total force of 215-220 hands, who began with the stark frame and ended when the shiny car, practically complete except for body, hood, and windshield, was driven out on John R. Street.

Everywhere in Highland Park by the end of 1914 continuous motion was the rule; a kinetic spirit pulsed through the plant; its circulatory system was as elaborate and vital as that of the human body. Moving assemblies were geared precisely with lines of component supply. This permitted a close spacing of machines to save lifting, and a minute subdivision of operations. Other automobile plants—Reo, Cadillac, Buick, White—could boast their own special triumphs of ingenu-

ity; but engineers found nowhere else a system so bold, rounded, and efficient as that of the Ford Company. Highland Park was full of arresting novelties. Its foundry, for example, stood in striking contrast with the Westinghouse foundry for making air-brake cylinders, using endless-chain methods where Westinghouse used an intermittently-moved endless train of small cars. Its work arrangement for bodies was picturesquely ingenious. "Like a railroad system with its stations, side-tracks, depots, and terminals," writes Faurote, "the body-painting and upholstering process line wends its way over three successive floors of the new, big six-story building on Manchester Avenue, now running straight for 850 feet at a time, turning right-angle corners, now going down-grade to the floor below, back and across, until finally the terminal is reached."

Just how were the main assembly lines and lines of component production and supply kept in harmony? For the chassis alone, from 1000 to 4000 pieces of each component had to be furnished every day at just the right point and right minute; a single failure, and the whole mechanism would come to a jarring standstill. Careful advance estimates were made for each component. Theoretically, a safety-margin of parts for 25,000 cars was kept in stock; actually, factory practice placed the maximum at enough parts for 5000 cars, the minimum at 3000. With a margin so thin, precise record keeping was essential. Superintendents had to know every hour just how many components were being produced and how many were in stock. Whenever danger of shortage appeared, the shortage chaser—a familiar figure in all automobile factories—flung himself into the breach. Counters and checkers reported to him. Verifying in person any ominous news, he mobilized the foremen concerned to repair deficiences. Three times a day he made typed reports in manifold to the factory clearing-house, at the same time chalking on blackboards in the clearing house office a statement of results in each factory-production department and each assembling department.

The exact situation with respect to demand for and supply of parts was thus kept continuously charted; foremen acted to fill impending gaps, and checkers hurried truckmen to move components to whatever areas most needed replenishment. The fact that the Highland Park shops were worked to capacity made the shortage-chaser a key officer. Danger stood always on the horizon. The man was incessantly

dashing to the rescue like Sheridan at Cedar Creek. And yet in thus living on the precipice edge of danger, the Ford plant found one of its economies. Every stocked part cost space, money, and time. To make a thousand automobiles a day, the company had to buy monthly about $8,000,000 worth of materials, drawn from a thousand different localities, and to unload a hundred freight cars every twenty-four hours. Continuous movement on narrow margins was one of the modes of reducing the price of the Model T.

A wonderful factory was Highland Park to the nation of 1914–a nation unaware in the spring of the cataclysmic crises that would soon confront it. Engineers came from all over America and Europe to study this achievement in efficiently standardized and specialized production. Nothing was concealed. Indeed, Henry Ford and his associates this year cooperated with the editors of *Engineering* in laying before the world, in the technically detailed and richly illustrated pages of Arnold and Faurote's *Ford Methods and the Ford Shops*, probably the best analysis of technology and management in a great factory yet published in any language.[55]

8.

Analyses made by the company in the winter of 1912–13 satisfied the officers that the country contained at least two million prospective Ford owners, and that for a long time to come a market could be found for 200,000 to 400,000 cars a year.[56] Every improved road widened the market. So did every price reduction. So did every step in Norval Hawkins's program of subdividing and intensifying the selling effort.

As success wreathed golden myrtle around the Model T, the annual gatherings of branch sales-managers grew exuberantly happy. The "family dinner" they held with Ford officials at the Pontchartrain Hotel on a July evening in 1911, for example, was a Lucullan feast. Tables had been placed in a great oval around the ballroom. A little hedge of privet eight inches high adorned the tables just inside the plates. The heart of the room was given up to a parklike expanse of grass and flowers with a series of circular speedways, along which miniature reproductions of all the Ford models made since 1903, filled with miniature men and women, were kept running all evening. Miniature street corners and crossroads were illuminated with tiny

electric lights. In the center a varicolored fountain played gaily. A masculine feast, without those alcoholic beverages which Ford condemned, but with music, song, and storytelling, kept the diners happy. Nor were they deprived of full opportunity to applaud the rosy statistics with which Hawkins edified them.[57]

The marketing of automobiles, as scores of manufacturers had found, was a difficult and dangerous field. Dealers were in general anxious to maintain and guard a large "territory"; manufacturers found it advantageous to restrict the field given each man. If manufacturers appointed too many agents and booked more orders than they could fill, conflict followed; the big dealers usually got the cars, while grumbling little dealers disseminated ill-will. Makers and dealers battled over discounts, over price-cutting on surplus stock, and over the distribution of advertising costs. Most companies which spent money on lavishly-appointed branch agencies with frock-coat-and-boutonnière managers rued their action.

For the Ford Company, the success of Model T swept nearly all such difficulties aside. Its seemingly impregnable position simplified the selling problem. Once Ford reduced his runabout first to $550, and then to $500, a gap of about $450 existed between it and the next really good car; and the avid market enabled Couzens and Hawkins to pattern the selling machinery on efficient lines. The survey by Messrs. Parlin and Youker for Curtis Publishing Company indicated that at least 15,000 buyers every year would have preferred a car of more stylistic distinction if they could have gotten it for only $100 above the Ford prices.[58] Any firm which started with a $750 car of handsome lines might have competed vigorously with Ford. To suggest this, however, was easier than to do it! The Model T stood unrivalled and untroubled, dictating its own terms to dealers.[59]

In enthusiasm and devotion, the 7000 Ford dealers of the spring of 1914 were surpassed by no other selling group in the country. As we have seen, they were allowed to handle Ford cars alone; the appearance of their salesrooms was vigilantly supervised; they could not sell accessories; they had to carry a stock of parts, and to give prompt aid to any owner in difficulty. Hawkins, as noted above, reduced the territory of city and rural dealers by taking away wards and townships they did not cultivate efficiently, and handing them to new dealers.[60] Despite these restrictions, the lucrative character of the business made men

eager for Ford agencies. The chief problem by 1913 was to choose among the influential men asking to be enrolled. Mayors, Congressmen, and ex-Governors were among the applicants. Highly revealing is the letter of William J. Harris, former chairman of the Federal Trade Commission, who, as Senator from Georgia, wrote his friend Edward N. Hurley that he needed some supplementary income:

> Mr. Arthur Lucas of Atlanta, Georgia, who is a good business man and has met with great success and who is an unusually fine man, suggests that if I could get another Ford Agency for the Ford Motor Company in Atlanta and Savannah, where he has large business interests, that he would furnish the capital and will give his personal attention to managing the business, while I would not have to be there except when Congress is not in session except for a few trips to Atlanta and Savannah now and then. . . .
>
> Through my insurance business I had connections with the business men and bankers in most of the towns and cities in Georgia, and I feel sure that this would be helpful to me in selling Ford cars. . . .
>
> If you would be kind enough to take this matter up with Mr. Henry Ford and help me secure an Agency at Atlanta and Savannah, I shall greatly appreciate it.[61]

Thirty branch agencies and service stations in the United States, nine in Canada, three in Europe, and one each in Australia and South America assisted in selling the Model T. Each had its manager, who maintained liaison with Detroit; each continually received men from the home office who gave advice in sales and service; and each domestic office had occasional surprise visits from travelling auditors.[62] The branches of course supervised dealers in their areas. The Detroit office, however, provided standard form contracts on an annual basis, carefully defining the territory allotted—usually with a map attached. England had nearly a thousand Ford dealers, who in 1913 sold 6129 cars, and in 1914 expected to dispose of 10,000. The Ford plant in Manchester had steadily expanded. "It takes the combined output of five of the next largest car manufacturers in this country," wrote Percival L. D. Perry in April, 1914, "to equal Ford sales."[63]

No other car, indeed, had the worldwide currency that the Ford had attained on the eve of the First World War. President Wilson bought a Model T for his summer place; and in announcing this fact, the Ford Company mentioned that "the Tasha Lama of Urga" had just completed a long Mongolian journey in his Ford, that a Ford

agent had been appointed in Iceland, that Winston Churchill had just made a dash in a Ford from Perth to see King George at Balmoral, that the Ford agency in Ceylon was enjoying a brisk trade among tea planters, and that the Model T had won the Johannesburg-Vereeniging race in South Africa. Approximately 550,000 Fords had been sold since the company started, and most of them were still running. And, trumpeted the *Ford Times:* "30,402 cars in 26 working days of 8 hours in April: 146 cars per hour, one car every 24 seconds."[64]

9.

In July, 1914, the company announced that on August 1 its prices would be cut by $60, bringing the runabout to $440, the touring car to $490, and the town car to $690. Moreover, it promised that if the company sold 300,000 new cars from August 1, 1914, to August 1, 1915, all retail buyers would share in the profits to the extent of $40 to $60 per car.[65] The company, the dealers, the public, had all benefited from the success of the Model T and the rapid development of mass production. But one important element remained to be considered. What had been happening to the workers, and what was to be their future?

XX

THE FIVE-DOLLAR DAY

No CHAPTER in the record of the Ford Motor Company is more dramatic than its introduction in 1913–14 of the most advanced labor policies yet known in large-scale American industry. To understand the full significance of this chapter, we must set it against the labor history of the decade 1903–13—in general a depressing history.

When the century began, the workers at first won some notable gains. The American Federation of Labor and other unions grew rapidly in strength; the anthracite miners under John Mitchell won a partial victory in their famous strike; and the Consumers' League and National Child Labor Committee focused challenging shafts of light on the sweat shop and child labor. But the enemies of organized labor, led by the National Association of Manufacturers, soon moved to a counter-attack. Throughout the country well-financed groups, denouncing labor tyranny, battled for the open shop—even the liberal Charles W. Eliot blessing their cause. The Anti-Boycott Association successfully fought the unions in two resounding legal contests, the Danbury Hatters' Case and the Bucks Stove and Range Case. Union membership, including the A. F. of L., soon declined. When a few labor extremists turned to terrorism and murder, killing ex-Governor Frank Steunenberg of Idaho in 1905 and dynamiting the Los Angeles Times Building in 1910, they sadly injured the moral standing of unionism. Internal dissensions, the effects of the panic of 1907, and the decay of craft skills under pressure of the machine, further weakened labor.[1]

In few cities during these years did labor have more discouraging pages to turn than in Detroit. This city became one of the open-shop capitals of the land, where workers had to fight with flimsy weapons against well-armed employers upholding a tradition as to hours, wages

and working conditions that was firmly opportunistic rather than liberal.

The most prominent features of the labor situation in Detroit were five: the determined hostility of most industrialists to unions; the large pool of immigrant (particularly East European) labor; the widespread use of adolescent workers; the prevalence of piece work; and the scant attention paid to safety. We might add that in the automobile industry, by 1910 predominant in southern Michigan over all others, the rapid turnover constituted a grim problem to which all too little thought was given. Of course, the city had its share of enlightened conscientious men. Henry M. Leland, for example, who was never accused of tenderness to labor, had the sense to say in 1911: "If tonight it was a question if every trade union in Detroit should be abolished, then I would stand, with my rifle if necessary, and say 'No! You don't do it!' Because that is the only weapon they have against the unscrupulous employers. Because there are many employers so unscrupulous that if it were not for the organization they would have them crushed, perhaps, just as the agitator pictures it. Therefore, we must have organized labor, but we must also have organized employers."[2] But Detroit also had many who disagreed with Leland; and organized capital got much the better of the uneven contest.

2.

Victory for the open shop, though not gained without fierce battles, was decisively won by the Employers' Association of Detroit. The collapse of the strikes called in 1907 by the Molders', Metal Polishers', and Machinists' unions constituted, as we have said, the Waterloo of organized labor. Thereafter workers in the metal trades were in a chastened mood, fighting minor skirmishes now and then, but never questioning the right of employers to hire non-union men at will. Meanwhile, the E. A. D. continued to build up its Labor Bureau as a recruitment center, useful in drawing new industries to the city, supplying them with help, breaking strikes, and permitting defeated strikers to seek reemployment without undue loss of face. The unions accused the E. A. D. of compiling a blacklist, which it denied, and of employing spies to observe and report upon union activities, which it in effect admitted.

J. J. Whirl, secretary of the Employers' Association, repeatedly em-

phasized the fact that the Labor Bureau was the main source of its strength. By 1906 it had listed about 40,000 workers, half of the whole Detroit labor force. Naturally, with this army of men at its call, the Association was able to break strike after strike. In the crucial battles of 1907 it threw large forces into the shops that the metal workers were trying to close. In 1911, Whirl was able to report that an entire department of the Hupp Works, forty men, had quit work one morning; that by afternoon the Labor Bureau had supplied twenty-eight new workers; and that a day or two later a dozen old hands had contritely reapplied, thus fully manning the department. The foundry strike of 1912 was met with instant vigor:

> We had long observed the cloud on the horizon [reported Whirl later], and our Bureau had made every possible preparation in advance of the storm. On the day it broke men were in the field, and hundreds of letters went forward to available men all over the country.
>
> In connection with this campaign of securing men for strike work, let it be understood that nowhere did an advertisement appear which did not clearly indicate that trouble existed; not one letter was mailed that did not positively say that a strike was in progress, and explain the cause of the trouble; every field man was cautioned to have this point clearly understood. . . . Within a day or two after the strike was called the shops were provided with a few men; each had a nucleus for a new working force, and gradually this was added to. Week after week passed and every day came the same encouraging report: "We are in a little better shape than yesterday."[18]

In state affairs, the Employers' Association stubbornly resisted a variety of progressive legislative proposals—bills for safety appliances in factories, child labor bills, factory inspection bills, and any bill favorable to unionism. In most of this negative activity it was successful. In city affairs, the Association was primarily concerned with the police protection of strikebreakers and a rigid enforcement of the criminal code against picketing strikers. The success or failure of a strike frequently turned upon the vigor of the picket line. If any employer was trying to operate his plant with scab labor, and if the Association supplied it in large numbers, as it almost always did, an effective picket line required mass picketing. Mass picketing usually meant riot and mayhem unless the police were numerous and resolute. The Association took strenuous action to see that they were both. It did not always gain its end—sometimes City Hall was on the union side; but

it grew more and more successful, especially after the injunction came into play against picket lines. This particular bludgeon was perfected in 1907, when the Wayne County Circuit Court issued seven labor injunctions of the most sweeping character.[4] Thereafter it was not necessary to prove that a picket had violated the criminal code; it was sufficient to show that he had overstepped one of the general prohibitions of the court.

Beyond question, the open shop activities of the Employers' Association contributed to the extraordinary industrial growth of Detroit. Some enemies of unions declared that they constituted the central explanation of this growth. "Why is Detroit?" asked C. M. Culver. "One will look in vain among the ordinary reasons for a city's being. Distributing center? No—pocketed. Proximity to raw materials? No—far from ore or fuel. Accessibility? Not when her development began. An agricultural center? No—Michigan is poor in farm products."[5] Though he overstated the case, for Detroit *was* a distributing center and enjoyed cheap water transportation for iron ore and some other raw materials, his assertion had force.

The reasons why Detroit emerged as the center of the automobile industry were really complex and numerous. They included the accident that Olds, Leland, and Ford all lived in the area; the importance of the city in the old-time wagon and carriage trade; its Pullman and freight-car shops; the existence of numerous foundries, machine shops, stove works, and marine engine plants which could be converted to automobile parts-manufacture at a time when quick, sure delivery of parts often made the difference between failure and success; and the city's median position between East and West. But the triumph of the open-shop movement was nevertheless an important factor, as is indicated by a long list of firms which the E. A. D. asserted had removed to Detroit because of its favorable labor conditions. This list in 1920 included the Packard Works, the Burroughs Adding Machine Company, the Chicago Pneumatic Tool Company, the Timken-Detroit Axle Company, the Hayes Manufacturing Company, the Michigan Steel Boat Company, and the Bowen Products Company. Motives naturally were often mixed; the Packard plant, for instance, may have come to Detroit partly for labor reasons, partly because Henry B. Joy, a leading spirit, preferred to work there. But it is certain that Detroit had an international reputation as a city of abundant and docile labor,

and that businessmen in other centers were constantly asking the E. A. D. the secret of its success.

While gaining a powerful position, the Employers' Association was sufficiently farsighted to caution against its abuse. It was not enough to defeat the labor unions in the open field; they must be permanently undermined by removal of their *raison d'être.* The Association constantly tried to impress upon the worker that it was friendly to him as an individual and anxious to improve his status. It insisted that except during spasms of labor warfare, it made no distinction between union and non-union labor. By refusing to penalize workers for former union membership, the Association rendered it easier for them to withdraw, and prevented the formation of a hard core of intransigent union men. In addition, Association leaders consistently urged fair policies upon their adherents. It was obvious that nobody did so much to create aggressive unions as grasping, brutal employers. The president of the Association remarked in 1907 that one of its worst enemies was "the smooth running clean open shop where for months there has been no complaint and as a result the employer gets the idea that the men will tolerate a little cut in wages, or the introduction of hours or shop conditions of which the Association would not approve. . . ."[6] And Secretary Whirl adjured the members: "Treat [the worker] as you think he should treat you."

The automotive industry was of course no important influence in the Employers' Association in its early years, for the industry was then small. By the time the car manufacturers became a power in the E. A. D., its principal battles had nearly all been fought and won. Henry M. Leland of the Cadillac Company, however, was a dominant figure from the beginning. Reports of the time asserted that early in life he had imbibed from conflicts with labor agitators a grim antipathy to unions, and that he had abandoned his purpose of establishing the Leland & Faulconer plant in Chicago because he arrived there on the day of the Haymarket Riot.[7] One by one the chief motor companies came in. Finally, in 1910, under the leadership of Hugh Chalmers, a majority of the remaining automobile makers and accessories manufacturers joined, both being included in the Automobile Division.[8]

By that year, the open-shop campaign won, the Employers' Association had shifted its objectives. Foremost among its new purposes were the replenishment of Detroit's labor supply to meet the ever-rising de-

mand for automobile workers; the combating of radical influences, and particularly the I. W. W.; the promotion of safety in the shops; and the discovery of a practical solution of the workingmen's compensation problem.

3.

The tremendous growth of Detroit industries in 1908–14, with the Ford Company in the van, made the provision of an adequate labor pool an urgent problem. The Employers' Association systematically exerted itself through agents, circulars, and news stories to draw men to the city. In the early spring of 1910 it placed advertisements for seven consecutive days in one or more newspapers in 191 places outside Detroit, and answered more than 2000 replies.[9] During the next twelve months, an estimated total of 20,000 or 22,000 workingmen arrived in the city, about half of them finding jobs through the Labor Bureau.[10] A heavy majority of the newcomers were foreign born, and a great part of them recent arrivals from Poland, Austria-Hungary, the Balkans, or Italy. By the spring of 1911 the whole labor force in Detroit was computed by the Employers' Association at 175,000—and of these 160,000 were manageable men on the Bureau's index! Even so, jobs were multiplying so fast that demand often exceeded the supply.

As factories filled the Detroit newspapers with flaring advertisements calling for hands, and shops competed in offering attractive terms, the annoyance and loss of rapid turnovers increased. Every Sunday the advertising columns would be full of appeals for help; every Monday morning department foremen were at their wits' end, surveying the losses to other local establishments and trying to fit green employees into the gaps. Naturally mobile and hungry for better opportunities, the workers formed habits of restlessness under this competition for men. The astute Mr. Whirl castigated the factory heads. They kept demanding production, production, he said; they devilled the life out of their managers, superintendents, and engineers to lift production higher and higher; they were always dissatisfied. The result was that foremen never had time to deal sanely with the situation. Since every vacancy meant so many fewer pieces finished at the close of day, the one thought of the bosses was, "Get the men!"[11]

The appropriate remedy was found in 1912. The employers held meetings in May. Competitive advertising was stopped; a fund was

subscribed to carry on an extensive canvass for labor in other areas; and by cooperative effort, a marginal supply of workers was brought into Detroit. In doing this, care was taken not to offend employers in other cities, and not to bring in mere drifters and malcontents.[12] Meanwhile, efforts—generally fumbling and inconclusive—were made to train men for highly skilled positions, thus dealing with a special phase of the labor shortage. The Employers' Association had founded a building trades school in 1905 which the city authorities took over several years later; but this did little to help machine shops, foundries, and automobile plants. The old-time apprentice system had entirely died, and nothing had been found to replace it.[13] During 1911-12 the Automobile Division of the Employers' Association held repeated meetings to discuss training problems, but agreed on no general plan, merely leaving the matter to each factory. Though Henry M. Leland instituted at Cadillac an effective Department of Instruction for young men, most establishments did little or nothing.

Radicalism found a good deal upon which to feed in Detroit. Secretary Whirl solemnly placed on record early in 1912 a statement designed to arouse his hearers: "There . . . is at this time more restlessness, more aggression among the workmen of Detroit and elsewhere than there has been for several years past. . . . There is a lot of inflammable matter scattered about the plants and it is up to you . . . whether or not a spark ignites it, or it is cleared away before damage results." Living conditions for labor were in great part deplorable. To be sure, the city was without any large congested tenement house districts akin to those of New York, Boston, Pittsburgh, and Chicago. Its tendency was to sprawl aimlessly over widening areas, so that from twenty-nine square miles in 1900 and thirty-six square miles in 1905 it grew to fifty by 1912; its population at that time was well above half a million, or about twice as much as at the beginning of the century. But if tenements were few in Detroit, there were plenty of shanty districts, of jerrybuilt two-and-four-family houses, and of mere hovels; schools, churches, and street railways lagged behind population growth; and the three older parks, Belle Isle, Palmer, and Clark, were not properly supplemented by newer recreation grounds. Vice ran wide open, and crimes of violence were frequent. Detroit was a frontier town.

The foreign-born who had flooded the city made a practice of rear-

ing numerous children and exploiting their earning-power from an early age. Judge Henry S. Hulbert of the Juvenile Court, speaking in 1912 to the Employers' Association, remarked that while American-born parents were glad to keep their children in school to sixteen, many immigrants were not:

> With them it is largely a matter of economics. They rear large families, and they begin, without exception almost, in poverty, and rise through a gradually increasing line of prosperity to a point where the maximum number of their children are of the working age and at home in the family, and then as the children marry or go out the parents, as a rule, go down the poverty side again. The children are kept in the school only so long as the law compels them to be there. They then force them into work, and confiscate the entire wages, almost to the last cent, for the family support. They build largely on the commercial value of their children. That means two things: first, that the parents want the child employed where he can earn the most money, regardless of what his future will be; second, that the child is going to become rapidly sick of the employment because he gets no benefit from it. . . . He gets his money in some other way, and then I get him as a delinquent child.[14]

Many Polish families, said Judge Hulbert, had an income of seventeen dollars a day, the father, the mother, and five, six, or seven children all working. Large numbers of boys, totally uneducated, earned $1.70–$1.80 a day at sixteen.

For young and mature alike, piece work (detested by Ford, but then the rule in Detroit machine shops and factories) and monotonous repetitive labor contributed, at least subconsciously, to the pervasive discontent. The master-workingman had almost disappeared before the advance of the machine. Labor unions, after a tenacious struggle to maintain the integrity of the worker as a craftsman, and an incessant warfare against the mere handy-men, had confessed defeat. By 1910 they were vying with each other in relaxing craft requirements and widening their entrance doors.[15] The more intelligent the employee, the less he liked this degraded status. Restless, energetic youths were quick to rebel. Leland in his Department of Instruction at the Cadillac plant had experimented with a sound plan. He picked young fellows carefully, gave them a two months' trial, and then put them through a two-year course in all departments. When this was completed they knew all the machinery, all the parts, and all the plant

procedures. Ford and his associates made some honest attempts, which did not get far, to keep men moving from one department to another to vary their experience. In most factories, however, monotony was the rule, and the inevitable consequences appeared. As Judge Hulbert put it:

> It is not at all surprising to me with our modern conditions that it is difficult to find the boy who wants to continue in one employment. Our modern shops are built on such an economical plan that we get one individual doing one thing until he becomes most efficient at that one thing. It is impossible to take a child and set him at one task and not have him chafe at that task. . . . Among the thousand or more boys who come to me in a year I find few that hold their positions more than three months. Generally they say they get tired of that one thing. They want to go into a shop where they get some other kind of a job, one perhaps as tiresome in the end, but it represents a change temporarily.[26]

Judge Hulbert added an indictment of piece-work payment:

> I personally do not believe in the piece system for children. You take a bright boy and he is able by speeding up, as you say, to turn out a big day's work. The boy's labor life is short. He will speed up more and more the more ambitious he is, and it will soon break him. I have case after case where boys who a year ago were able to earn from ten to eleven dollars a week on piece work are now on the street, and they don't want to do anything but work on the street. That attitude is brought on by overwork entirely. They may be exceptional cases, but I think it represents in a measure the problem. Piecework is bad for the child and for the employer because of its after results.[27]

This admonition had no effect on the audience; piece work, though avoided by the Ford Company and some other establishments, remained for many years the rule in Detroit industry.

The safety movement in American industry did not get vigorously under way until 1907, when the American Museum of Safety was established in New York, and the Association of Iron and Steel Engineers, long a crusading body in the field, was founded.[28] Detroit was neither a leader nor a laggard in the movement. It was to the credit of the Employers' Association that it was shocked by both the national and local record. Taking the country at large, the disregard of life in mines, steel mills, machine shops, and transportation industries was frightful. During 1907 more than 4500 men were killed on steam

railroads, and 87,644 injured. In the manufacturing industries alone casualties for the war year 1917 (with 11,338 killed, and 1,363,000 injured) far exceeded those on the battlefield. The president of the E. A. D. in 1910, pointing out how needless were such losses (for Britain and Germany kept accidents at low levels) declared: "I am in dead earnest in trying to save life and limb."[19]

In Detroit, as elsewhere, the rapid introduction of complicated new machinery, the high proportion of inexperienced, illiterate immigrants in the labor force, and the negligence of employers were the chief factors in the appalling loss of life. The negligence could be ended. A Committee on Safety and Sanitation was appointed by the E. A. D.; later in 1910 a Factory Inspection Department, with a full-time agent, was created; and in a little over five months, 375 surveys of plants resulted in 1350 suggestions for improvements. As Secretary Whirl pointed out, if the industry did not furnish safety appliances, the state government would step in with drastic laws.[20] All this activity by the Employers' Association, with the national agitation carried on by journalists and labor leaders, the publication of a revealing volume of the Pittsburgh Survey, Crystal Eastman's *Work Accidents and the Law,* and the statistics issued by state and national agencies, had a marked influence on the Detroit situation. The Ford Company felt the impact of the movement, which was at its height when Highland Park was built and equipped, and responded with exemplary regulations and safeguards.

Allied with this effort to reduce accidents, so costly to employers as well as employees, was the wave of workmen's compensation legislation which rapidly overswept the industrial states. Here, too, the Employers' Association, aware that legislative action was inevitable, took an enlightened position. The American public would no longer tolerate reliance on the common law alone. In modern mechanized civilization, the wrangle over "contributory" or "fellow servant" negligence was anachronistic; the cost of accidents must be met in the first instance by the industry and in the second by the consumer. Couzens was a member of the E. A. D. Committee on Workmen's Compensation, which in 1912 helped enact Michigan's first law. The Association had grasped the truth expressed by another of its committees: "The days of the assumption of risk, of the fellow servant risk, and of the contributory negligence risk, have gone never to return; for no change

that may ever be made in the present law will reincorporate those barbarous conditions of a dead age of individualism."[21]

Bad living conditions, child labor, piecework, high accident rates, were national rather than local evils, while the peculiar grievances of Detroit workers were the militancy of the open-shop movement and the shattering effect of the subdivision of work on craft skills and craft cohesion. As strong unions disappeared, the Industrial Workers of the World tried to move into the power vacuum. We have seen that regular union leaders outlawed the I. W. W. Never numerically strong, it won national influence through the ability of its leaders—William D. Haywood, Elizabeth Gurley Flynn, Joseph J. Ettor, and others—and the revolutionary enthusiasm of its members. In 1912 it helped carry a desperate textile strike in Lawrence, Mass., to victory, and fought bravely against a conservative reign of terror in San Diego. In 1913 it waged a memorable battle in Paterson, N. J., lost it, and began to decline.

The I. W. W. for a time alarmed Detroit employers, who like industrialists elsewhere exaggerated its strength. This was actually small; in May, 1913, the I. W. W. Auto Workers Union laid claim to only about 200 members, an insignificant number in proportion to the 60,000 auto employees of the city.[22] At the height of its activities in Detroit that summer the I. W. W. could not have attained a maximum membership of more than 2000 in the motor factories.[23] Its organizers appeared from time to time at the gates of all the major plants, including Ford's, and proselytised vigorously despite the opposition of police, courts, and old-line union leaders; but they did not get far. When in June the leaders succeeded in calling out about 2000 employees of the Studebaker Corportion, the strike collapsed after a week.[24] Thereafter the aggressive new union, bitterly attacked by Gompers and the A. F. of L. as well as by employers, and crippled in public esteem by its resort to sabotage, lost ground in Detroit as in the country at large. But it had indicated the existence of considerable underlying unrest, and done something in preparing a psychology favorable to the eventual rise of industrial unionism among the unskilled workers in the new mass industries.

4.

The existence of a "labor problem" transcending mere questions of

demand and supply hardly reached the consciousness of Ford Company leaders before 1911–12. Of course Ford and Couzens were aware of the tides of social reform which grew potent under Theodore Roosevelt and were to reach a flood mark under Woodrow Wilson. As a member of the Employers' Association from 1903* and more active in it after Hugh Chalmers brought in a vigorous automotive group, the Ford Company had shared in its reformative as well as repressive activities: in its opposition to wage slashing, its safety campaign, and its interest in workmen's compensation. Henry Ford retained a lively recollection of the fact that he had been a mechanic himself, and he never lost his sociable interest in human beings and his liking for young men. Couzens, rough-tempered, absorbed in company expansion and finance, had kindly flashes and a strong civic spirit. For several reasons, however, labor got no special consideration until the tardy date mentioned.

One reason is that until after 1910 the Ford Company was not one of the largest employers. In that year its labor force took only sixth rank in the area. General Motors stood first, with about 10,000 men, Buick with almost 4000 and Cadillac with 3500 making the bulk of these.[25] Then came Studebaker with 5700,[26] Packard with 4640. The Ford Company, with an average of 2595 employees, had fewer workers than Olds and Chalmers, or Briscoe and Chalmers, combined. For the fiscal year ending September 30, 1911, however, the number of Ford employees rose to 3488, and for 1912 to 5710; while in 1913 it shot up to 13,198—a number posing obvious difficulties.

Another reason for the delay is that during the creation of Model T and its rise to dazzling success, the morale of the Ford workers had found a special stimulus; the men felt that they were working together toward a goal which promised handsome rewards for all. An atmosphere of creative excitement filled the plant. Ford himself in this developmental period, elated and optimistic, moved about the shops radiating cheery good feeling. Democratic, affable, his "mean streak" suppressed by the happy sense of achievement, he showed sides of his nature which inspired loyalty and exceptional effort.[27] According to a somewhat uncritical admirer:

> Mr. Ford used to get out there and say, "I wonder if we'll get up to No. 10." He'd be out there in the factory, watching them and kidding them and

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* The Ford Motor Company signed the articles of agreement for the E.A.D. in 1903, but did not pay dues until 1908 or later.

> telling stories. God! He could get anything out of the men because he just talked and would tell them stories. He'd never say, "I want this done!" He'd say, "I wonder if we can do it. I wonder." Well, the men would just break their necks to see if they could do it. They knew what he wanted. They figured it was a coming thing, and they'd do their best.[28]

For still another reason, while Ford was intensely preoccupied with design and production and Couzens with business problems, and while profits remained moderate, it was natural to drift on the full current supplied by the E. A. D. Labor Bureau. Max Wollering tells us that in the Bellevue Plant days Ford "never expressed himself very much on wage policies," but left them to subordinates, who were apparently expected to hire men at prevailing wage rates. However, he suggests that when Ford did interfere it was to raise the payments. "Mr. Ford was very liberal as far as the hourly workers were concerned during my stay at the Ford Company, anyway."[29] Just how much or little is meant by this statement it is impossible to say. Our evidence on wages and hours down to 1911 is thin and fragmentary. We do have an undated list of 140 employees, however, the names indicating employment in late 1905 or early 1906, which partially bears out Wollering's statement. It shows that these men worked nine hours, the Detroit norm being ten; that those in the machine shop got 14 to 65 cents an hour, with an average of 42 cents; and that laborers were paid 28 cents. These wages in 1905–06 compared favorably with others in Detroit.[30] Evidently the Ford Company was paying the going rates, with some upward revision for good men.

Surviving company records for three months of 1908 and all of 1909–10 indicate that the wages of production workers had fallen considerably from the 1905 level. They also hint (though they do *not* prove) that the ten-hour day had been re-established.[31] Here again the Ford Company was following current tendencies. As plant operations were subdivided and less skill was required, wages tended toward a lower average.

Putting together all our scanty evidence for the Ford plants, we can reach a coherent if by no means complete story of wages and hours down to the occupation of Highland Park. Beginning in 1903 with the little Mack Street group of ten or a dozen young fellows and a foreman working 60 hours a week at $1.50 a day, the company increased wages and adopted a nine-hour day (Saturday hours unknown) some-

time in 1904 or 1905; but it apparently did not have the shorter day at the Ford Manufacturing Company (Bellevue plant), which worked a 55-hour week. Sometime later a much increased working force was put on the standard 60-hour week of Detroit, and wage rates were gradually reduced, probably by hiring new workers for less skilled jobs. In November, 1908, production workers averaged $1.894 for a ten-hour day, and non-production help $2.258. Then wages began to rise. In the fall of 1909 production workers were getting $2.368 for a ten-hour day, and non-production workers $2.677. By the summer of 1910, production men averaged $2.514.[32]

During the whole period 1903–10, the worker's tenure in the Ford plants was as insecure as in other automobile factories of Detroit. T. A. Mallon, who was in and out of Piquette, Bellevue, and the downtown branch several times, declares: "They'd hire and fire you. My job wasn't actually secure in those days. Nobody's was."[33] We have noted the evidence that under Al Andrich's lax supervision at Piquette, at least part of the shop was dirty. Wollering, however, asserts that in general Ford was strict about cleanliness;[34] and indeed numerous men testify that he established an industry-wide reputation for neatness. State inspectors frequently ordered automobile factories to clean up their toilets; only one such order was issued to the Ford plant. Inspectors constantly compelled other plants to take safety precautions. Only one safety order of record was ever issued to the Ford Company, that being in 1905.[35] It is true that this order was fairly comprehensive: the company was to cover all exposed gearing and set-screws, guard a band saw and the knives on a jointer machine in the pattern shop, guard the engine fly wheel, and remove a paint-rack from the entrance to the fire-escape.

In his antagonism to piece work Ford was actuated not only by a conviction that hurry led to nervous workers and botched parts, but by the consideration that his company was changing its methods of production so frequently that piece rates would have meant endless bother. Of course, after the coming of mass production, a piecework system would have been meaningless where the new type of assembly was concerned, since the speed of the line controlled the speed of the worker.[36]

Neither under Andrich nor Max Wollering, under Walter Flanders or Walborn, were the employees really driven; and under all four men

the company seems to have maintained a good deal of *esprit de corps* in its shops. But with the rise of "Pete" Martin, the tough French-Canadian, and of Charles Sorensen as his principal lieutenant, the situation became more difficult. Martin and Sorensen were drivers; persuasion and leadership on the shop floor were supplanted by drill-sergeant methods.

As the size of the labor force increased, moreover, control of the men had to be more largely deputed. Once the worker was put on the payroll, equipped with a badge, and sent to his department, he was under the all but absolute authority of his immediate foreman. The size of his wage-check, the severity of the production standard assigned him, the time given him to learn his job, his chances of promotion or transfer, his tenure—all this lay within the range of the foreman's discretion. Above all, the foreman's right of arbitrary and unchallengeable discharge was accepted as the cornerstone of efficient labor practise. This was true of most large American factories at the time; it was true of practically all big motor works.[37] Many foremen were arbitrary, prejudiced, and brutal—and hence the chronic galling turnover of men.

Beginning in 1911-12, the company was thus forced to recognize the existence of an intricate labor problem. The employment market was tight; many workers were increasingly restive; sociologists and reformers were outspoken about abuses. Certain incidents, moreover, dramatized the blind confusion of the situation. John R. Lee, who on coming from the Keim Works had been given charge of employment, later recounted one. An experienced drop hammer operator suddenly showed a total inability to meet moderate production standards. His health was sound; he had no grievance against the company. But an inquiry showed that his wife was ill and that as a result his children were neglected, and his debts mounting. As soon as the company removed that worry, his production rose to normal. Lee and others suddenly comprehended the intimate relation between an employee's efficiency and his home life, recreations, and sense of security or insecurity.

Lee burned with an ambition to make the Ford plant a model in labor management. He found Ford and Couzens in a responsive mood, for both had been pondering the subject. After discussion, they asked him to investigate the methods of other factories in handling workers,

and sent him on a tour of inspection. He returned convinced that not a single plant had met the situation wisely, and that the Ford Company would have to devise its own policies. It did not occur to him or Ford that trained experts in labor relations might be helpful, though such men were now available, and the Rockefellers shortly called on Mackenzie King, of Harvard training, to help them deal with the Colorado Fuel & Iron imbroglio. As a matter of fact, Lee himself was quite equal to the situation. As a first step toward a better labor regime, he at once began to systematize the chaotic wage structure of the Ford Company.[38]

Another powerful factor in compelling the company to formulate a carefully studied labor policy was the sheer pressure of its profits. The net income went above $4 millions in the calendar year 1910, above $7 millions in 1911, and above $13.5 millions in 1913. Dividends declared during 1913 aggregated $15.2 millions. As Ford and Couzens became colossally rich, as they paid executives higher salaries and bonuses, and as they gave the public cheaper and cheaper cars, they had to ask themselves: "What of our workers?" Was it fair of a corporation which by 1913 had more than $28 millions in surplus to keep paying Tom Smith and Carlo Pastucci only $2 or $2.50 a day?

A still further consideration with the leaders of the Ford Motor Company may have been the depression of 1913–1914, which had already begun to develop. It had affected Detroit as well as other cities —its character and extent will be discussed further in the ensuing chapter—and with time would be felt more keenly. For the year ending June 30, 1913, the local condition seems to have been fairly normal; it worsened sharply in the ensuing twelve months, and continued to grow darker.* Ford, Lee, Couzens—all were doubtless aware of the situation at the beginning of 1914, and could appreciate the value of any action taken by the Company which might help if only slightly to mitigate the sinister outlook.

* Leona Garrity, in her unpublished Master's thesis, "The Story of the Poor Commission of Detroit, 1880–1918," Wayne University, 1940, gives the number of persons granted relief by

The time had come to turn a new leaf in Ford policy. A liberal course had become desirable both industrially and socially; and developing rapidly along several lines, it reached its climax early in the year in an announcement that shook the country.

5.

Before we describe this announcement, let us look at several of the less striking but highly important elements in the new policy. Safety measures were one; the Ford Company had long given them considerable attention, but now they were both improved and extended. As close observers often remarked, the endlessly repetitive motions of mass production enhanced the ordinary dangers of machine work. Working motions gradually became automatic, or nearly that, until men toiled heedlessly, their minds far away from the whirling wheels, gears, and blades about them. Moreover, the rhythmic noises of the great factory induced a certain torpor; "the steady hum of the lathe, the incessant tapping of the hammers, the dull thud of the presses, the click-clack of the shapers, the whirr of the drills, the groaning and [illegible] " all combined to create [illegible] an's mind emerges only [illegible], adding that factory accidents might be divided into two groups, those springing from external and those from internal causes. The first were attributable to imperfectly guarded machinery, bad lighting, uneven floors, or some earlier defect; the second were the product of regulations, careless mishandling of tools, or the peculiar mental states just noted.

At Highland Park every precaution was taken to prevent accidents from external causes. The lighting was superb. Iron railings were built around machines; wire cages were placed at the exposed ends of belts and shafting; screens were used to cover teeth and cutting edges; sheet-metal protectors were installed around whirling fly wheels. A great variety of shields and guards were employed. When the crane swung to run down the craneway, carrying some heavy burden, a man with a whistle preceded it. Sand boxes were distributed throughout the foundry and heat-treating plant. If a fire broke out in the 1200-gallon vat of liquid enamel, a highly inflammable substance, it was easily suppressed; turn a cock, and the entire contents of the vat vanished into an underground tank outside the factory walls, while a system of steam jets quenched what fire remained.

The internal or psychological causes of accidents, which were much more difficult to reach, were combated in a variety of ways. Special devices were used to awaken the operators of machinery as they approached a danger point: raucous bells, placards of flaring brilliancy, suddenly erupting signals. Nobody could turn the starting switch for a draw press until he had removed a large red metal tag. The shop was full of warning signs, and of cards announcing: "To stop this machine pull plug."[39] The lever of a hand press bore aloft a bright red flag. The officers worked busily trying to instruct their polyglot and often illiterate men. But, inescapably, accidents remained numerous.

The wage system when Ford and John R. Lee began their reforms was an archaic absurdity. Foremen had fixed a weird variety of payment scales. Just how many different rates existed it is impossible to say; Lee speaks of finding sixty-five when he made his survey in 1913. These he reduced to eight. The resulting wage structure, established by a process of job evaluation, provided for seven classes of workers: mechanics (tool and die makers, and others of high skill), sub-foremen, skilled operators, operators, helpers, laborers, and specials (for example, messengers). When Lee instituted his new payment plan, effective October 1, 1913, he announced that every worker would get a raise in wages—the increase for the whole factory being 13 per cent —and that the management would try to grade all men according to their efficiency. In four of the seven general divisions he had made three sub-divisions:*

> As an illustration, in our so-called C grade, we classify all machine operators and car assemblers. As a sub-division in C grade, we have beginners, those just starting to work. Men entering our employ in this grade all receive the same wage. As soon as the man has demonstrated his ability and becomes an operator of average proficiency, it is expected that his foreman will advance his wage by a certain fixed sum, and his skill rating to C2, and again after the man has advanced to . . . a first-class workman, another raise in pay is given him and his skill rating is advanced to C1.[40]

A first-class workman who had been with the company for two years or more received for his constancy a special addition to his wage. A minimum wage was fixed at 26 cents an hour for laborers, and a maximum at 54 cents for skilled mechanics, the eight different rates rang-

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* This would seem to make fifteen grades in all; but overlapping reduced them to eight. The lowest rate paid was 23 cents for the "special" group of women, messengers, and others.

ing between these points. "In each general grade and subdivision thereof," announced Lee, "a certain fixed rate applies, which may not be deviated from."[41]

Simultaneously, the Ford management took action to protect employees from misdirected assignments and from arbitrary or discriminatory conduct by the foremen. As Ford well knew and as Lee found, the factory was full of misfits. For one reason, men striving to get on the payroll often misrepresented their skills. Jan Kuzelick, a tailor, standing in line in the employment office, heard the applicant just ahead of him say that he was a machinist, and saw him instantly hired. Jan thereupon said that he too was a machinist, hoping that somehow he could learn enough in a few days to keep the job and support his family. The foreman found him incompetent and he was discharged. Foremen and bosses often took an unreasonable dislike to some hand, or unduly favored another. Now the rule was laid down that although a foreman might oust a man from his department, he could not discharge anybody. Jan Kuzelick was examined, found suited to the upholstering department, and given a second chance. Thus a better upholstering man was perhaps gained than by advertising for one.

Every hand was expected to make a steady advance from low or totally unskilled standing to that of a first-class workman. If he fell behind the average wage, an investigation was made, the causes of the delay were defined and if possible cured, and he was set on the road to promotion. Care was taken to see that men of quiet disposition were not shoved aside by aggressive self-advertisers.[42] Job assignments were constantly reviewed to suit the individual capacities of employees to their tasks, and foremen were reprimanded if they failed to do a good deal of this on their own initiative. Thus workers were assured of proper pay-increases, and a check was placed on the supervisory acumen of their immediate superiors. The effect of this change was striking. Turnover almost disappeared; in six months ending April, 1916, only one man was discharged.[43] Because of the continuous employment thus initiated, said Oscar Bornholdt, "Ford could get more out of the men than any other industry."[44]

Clerical workers shared with production hands in these benefits; and they had one extra advantage—an annual vacation of eighteen days which Couzens instituted at the beginning of 1913. Against this vacation, however, Couzens, being the martinet he was, charged penalty

time for all errors in work, a half-day for every instance of tardiness, and all off-duty time for any reason whatever, even illness. If the total penalties exceeded eighteen days, the excess would be deducted from salary.[45]

Profit-sharing in the conventional sense of year-end bonuses ran back in Ford history to December, 1905, when ten dollars was paid at Christmas to all office workers.[46] Beginning in 1908 the bonus was extended to the factory force on a seniority basis.[47] Men with the company one year got five per cent of their annual pay, men two years or more seven and a half per cent. In 1909 and again in 1910, under a carefully revised scheme, the gradation ran five, seven and a half, and ten per cent for one-, two-, and three-year men respectively.[48] Then in 1911 the management, apparently feeling that efficiency rather than length of service should be the basis, simply distributed $82,500 to select lists of employees, and in 1912 thus distributed $434,000. Branch managers, now a numerous body, were allotted a thick slice of these sums.[49] A similar efficiency bonus of $275,000 was paid in 1913, along with a ten per cent of pay bonus for about 640 employees of three years' standing or more who did not share in the lump sum.[50]

It will be seen that this so-called profit-sharing had been erratic and partial, costing the company little. A reasonable generosity had been shown to successful executives, sales managers, and office workers, and had occasionally been extended to long-service employees. Even a half-million in bonuses in the calendar years 1912 and 1913 would have been modest in comparison with the net profits of more than $13,500,000 and $27,000,000. The bonus system had no evident connection with the startling new departure in wage policy announced at the beginning of 1914. It, like the attention to safety, the reclassification of worker status and pay, the provision for systematic promotion, and the establishment in the fall of 1913 of an Employees' Savings and Loan Association administered by Lee, Klingensmith, and W. C. White, showed tha [illegible] creasingly conscious of the need for a [illegible] not indicate a revolutionary approa [illegible] rastic approach would be animated by the spirit of a statement made by Ford's old employer and long-time friend, Thomas A. Edison, in 1912:

You see, getting down to the bottom of things, this is a pretty raw, crude

civilization of ours—pretty wasteful, pretty cruel, which often comes to the same thing, doesn't it? And in a lot of respects we Americans are the rawest and crudest of all. Our production, our factory laws, our charities, our relations between capital and labor, our distribution—all wrong, out of gear. We've stumbled along for a while, trying to run a new civilization in old ways, but we've got to start to make this world over.[52]

Make the world over! That was the challenge of Theodore Roosevelt, Woodrow Wilson, and progressives and radicals in 1913. And as a global war and the rise of Communism were soon to show, a start could not be made too soon.

6.

But the Ford Company now did its bit toward a start. On December 31, 1913, a directors' meeting was held at the Highland Park plant. Besides dealing with representation in Argentina, it decided to pay all employees who did not come under the efficiency bonus plan of the preceding month and who had been with the company three years or more a ten per cent bonus. This meant that about 640 company employees would divide $60,000. The action emphasized the bleak position of wage earners.[53]

Either next day—New Year's Day of 1914—or the following Sunday (for the evidence is conflicting) Ford convened a meeting in his office to discuss production and wages for the coming year. Couzens, P. E. Martin, John R. Lee, Harold Wills, Norval Hawkins, and Charles Sorensen attended.* Essentially, the group were dealing with the company budget. Originally the sales department had carefully estimated each year how many cars it could sell, and the company had manufactured about that many—for an excess of cars could heavily injure its finances and prestige. But since 1911 Ford had discarded these precautions. The company, confident that demand for the Model T would outrun supply, made all the cars it could. Estimates of the machine tools needed had to be prepared (to raise production from 400 to 700 cars daily, for example, required careful re-tooling), and others made for materials required, working force, monthly output, profits—and wages.

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* Charles Sorensen states (*Reminiscences*) that only Ford, "Ed" Martin (also called "P.E." and "Pete"), Lee, and himself were present; that Ford came determined to institute the Five Dollar Day; that Martin and Lee both opposed it, but soon gave way; and that Couzens was then separately approached for his consent, which he readily gave. But other accounts speak of Couzens, Wills, and Hawkins as present, which under all the circumstances seems more likely. After the lapse of forty years, the precise facts about this fateful conference are irrecoverable.

Ford, presiding, was in a thoughtful mood. He had recently walked through the factory (so he later told W. J. Cameron) with Edsel. He saw two men fighting, and was ashamed that workers in the plant should fight before his son. Going home that night, he had begun to think. Why should grown men in a shop get angry at each other and use their fists? Lee's words had made an impression; he concluded that men acted like savages when they had barbarous living conditions, and that living conditions were barbarous when they were paid a mere subsistence wage. Executives shared the huge profits—customers shared the profits; what of the workers?

As discussion of the 1914 program progressed, Ford covered his blackboard with figures. When he set down the totals for wages, they seemed too small compared with anticipated profits. He kept raising the average—to $3, to $3.50; then, over Martin's vehement protest but with Wills's support, to $4 and $4.50. Couzens, according to one account, had been watching with ill-concealed hostility. "Well," he finally snapped, "so it's up to $4.75. I dare you to make it $5!" And at once Ford did so.[54]

On January 5, another directors' meeting was held, with only Ford, Couzens, and Horace Rackham present. The two active officers suggested (if Couzens was really hostile at first, he had fallen into line) that a better equalization of earnings between stockholders and labor was needed. "The plan was gone over at considerable length," state the minutes. Then Rackham assented, and the five-dollar wage was unanimously approved, to take force on the 12th. "Which plan," run the minutes, "it was distinctly understood would approximate an additional expenditure for the same volume of business of Ten Million ($10,000,000) dollars, for the year 1914."

Later that day Ford and Couzens gave the press an announcement that the company was reducing the work day to eight hours, converting the factory to three shifts instead of two, and instituting a five-dollar basic wage They handed out a typed two-page statement explaining the policy. Its crude rhetorical flourishes were not without justification: "the greatest and most successful" automobile company in the world would "inaugurate the greatest revolution in the matter of rewards for its workers ever known to the the industrial world." Every worker of twenty-two or over would receive "a share in the profits of the house" sufficient to make the minimum wage five dollars; nine-tenths of the employees would get this increase at once; young

men under twenty-two might share if they had dependents; and the working force was thus expected to divide an additional ten millions in the current year. "This," said Ford to reporters, "is neither charity nor wages, but profit sharing and efficiency engineering."[55]

It was evident that the plan had been incompletely formulated when announced to the press. Nothing was said about salaried personnel, branch assembly workers, or women employees. The Ford Company had to give the press a number of informal supplementary statements. Newspaper stories soon informed the public that salaried employees would benefit by a revision of pay, and that Ford had assured the Long Island workers that they and all other branch hands were included in the plan. Attending the Automobile Show in New York, Ford was asked about women, who had been earning an average of $2.07 a day. Admitting that they had been overlooked, he explained that "we expect the young ladies to get married," but added that while they stayed they would enjoy "a proportionate increase."[56]

In that quiet January, the world for the most part lapped in peace, the current of Wilsonian reform in America running strong, Ford's announcement was like the dazzling burst of a rocket in velvet skies. Headlines blazed throughout the globe. Overnight both heads of the company became international celebrities. A week earlier one had been mentioned in the press as "George" Couzens, the other as Henry B. or Henry S. Ford; a week later an aura surrounded both names. Every happening in the Ford plant suddenly became news. Even in November, with a great war raging, the announcement that 9200 men and women were being paid $5 or more loosed new headlines and editorials.

The public response was overwhelmingly approbatory. Nine-tenths of the newspaper comment was favorable, much of it almost ecstatic. Industrialists, labor leaders, sociologists, ministers, politicians, all hailed the innovation in glowing terms. Not a few commentators perceived the underlying connection which linked high production, high wages, and high consumption, pointing out that a new economic era might find in the Ford announcement a convenient birth date. Already, by virtue of the Model T, his swift rise from overalls to millions, and his democratic expansiveness and folksiness, all well publicized, Ford had become something of a popular hero, particularly in his own Middle West. That his talents in mechanics and plant organization amounted

to hardly less than genius was well understood; and touches were now added to the portrait which gave him the more doubtful lineaments of a great philanthropist, economist, and social scientist. Even highly conservative organs of opinion showed enthusiasm. "Let us all acknowledge," declared the *Michigan Manufacturer and Financial Record*, "that it is the most generous stroke of policy between captain of industry and worker that the country has ever seen."[57]

Beneath the froth of immediate comment, the new wage policy unquestionably built a solid foundation of popularity for the Ford Company and its principal founder. Millions who had their doubts about Ford's judgment, who regarded him as slightly eccentric, who even wondered if his motives were not mixed, nevertheless found an underlying admiration forming in their minds. To have fought so stubbornly to get an automobile factory started; to have toiled still more stubbornly to devote that factory to just one durable, versatile, and very cheap car; to have assembled a staff which pioneered so creatively in mass production; to have welcomed competition, battled in the long Selden suit for full freedom to produce, scorned protective tariffs, fought clear of Wall Street, and remained a man of the people —all this was impressive enough. But, while doubling the prevalent wage rate, to proclaim that the roughest day laborer could be made worth $5 a day was even more appealing; it touched men's imaginations. Ford's ways might be unusual, but men's hearts beat more warmly after that January news. When some critics expressed fear that such big wages would go to the workers' heads and harm them, the general instinct of Americans disdained that cynic view. As the *Record* said: "Greater earning power never had any other effect than elevation."[58]

The inevitable criticism pursued three main lines: the Ford announcement was unfair to less prosperous industrialists, it was essentially uneconomic as a long-range policy, and its surface altruism masked a deep selfishness. "Mr. Ford is privileged to do as he pleases," said some, with the gloomy air of men watching a bull wreck a shop of fine china.[59]

Hugh Chalmers, an acknowledged leader in the Detroit motor industry, made it plain that he thought Ford should have consulted other employers before taking his "radical" step. Fellow manufacturers agreed with him that it would be utterly impossible for them to follow the plan.[60] They, and car-makers in other cities, feared that

the inevitable comparisons would awaken discontent in the breasts of their workers. To be sure, some industrialists harbored a resentful feeling that Ford was "a traitor to his class"—a sentiment deepened by the applause which went up from labor, Socialists, and leftists generally.[61]

As for the economics of the step, critics pointed out that it was not true profit-sharing; that it would have slight effect on general wage-levels because of the local and national pool of unemployed; and that if falling profits necessitated a wage reduction, the Ford workers might become ugly-tempered. Three years later John R. Lee implied that the criticism of the five-dollar day by Detroit industrialists furnished one of Ford's reasons for withdrawing from the Employers' Association.[62]

The charge of selfish motivation was of course widely echoed and long sustained. *The Wall Street Journal* began by attacking Ford on vaguely emotional grounds. His injection of "Biblical or spiritual principles into a field where they do not belong" might "get advertising and get riddance to Henry Ford of his troublesome millions," but it would mean "material, financial, and factory disorganization."[63] Five days later the editor was more specific. He had discovered that the object of the Ford management was "to checkmate competition by the Dodge Brothers" by depriving them of dividends, and creating conditions in the labor market which would make it very difficult for them to produce their new car after the middle of the year.[64] This was improbable, although the Dodge Brothers had actually complained. The *Industrial World* of Pittsburgh was equally bitter. Ford's "madness for publicity," it declared, had led him into an act which really represented more calculation than philanthropy. Injuring competitors, it would benefit him:

> Mr. Ford probably expects through his present offer to get the pick of the mechanics of the industry. This accomplished, the high wage standard probably will be made the pretext for a campaign of merciless speeding-up and driving of men. In the end Mr. Ford will have got his money back; but what about his neighbor in the labor market?[65]

What were the true motives of the Ford management, and what was the precise genesis of the five-dollar-a-day plan? Both questions are exceedingly difficult to answer.

7.

A combination of several different factors explains the adoption of the five-dollar day. Suggestions that the management was actuated by a desire to get the pick of Detroit mechanics, and by anxiety to end a high turnover rate, though often repeated, are demonstrably false and misleading. The mass-production methods of the Ford plant made it unnecessary to search for picked mechanics. Every visitor to the plant saw that its basic employment principle was to take ordinary men and train each to do one small job well. It found no difficulty in getting the relatively few highly-trained mechanics it wanted; the Ford Company had always paid wages as good as or better than those of its rivals, and Highland Park offered superior working conditions. As for turnover, the reorganization put into effect on October 1, 1913, and the wage increases then made, were designed in part to reduce the turnover rate; and it was plain by the end of the month that they had been successful. The proportion of "quits" and discharges to total employment had run as high as 48 per cent in the not untypical month of December, 1912—for turnover was scandalous in nearly all motor plants. In October, 1913, it fell to 6.4 per cent![66] In short, the turnover problem had apparently been practically solved before the five-dollar wage was adopted.

Another suggested motivation for the five-dollar move, specially emphasized by Keith Sward, is the presumed concern of the management over the threat of the I. W. W.[67] Though it is true that Detroit employers took the I. W. W. invasion seriously, this theory is not supported by real evidence. As we have seen, the national strength of the I. W. W. declined when the Paterson strike was broken; it failed in its strike against the Studebaker Corporation in the spring of 1913; its Detroit membership probably never exceeded 2000; it was hated by the older unions. It had shot its feeble bolt long before the wage decision. Joseph Galamb recalls that "Mr. Ford said he would lick the I. W. W. by paying the men $5 a day,"[68] and this consideration may have influenced the industrialist; but not greatly, for the I. W. W. was already licked. The fact that workers in other plants did *not* get a high wage might have seemed likely to arouse a discontent there favorable to I. W. W. proselytizers; but their efforts in 1914–15 to gain adherents failed and they declined in strength.

Nor can we attach any weight to the hypothesis that in its spectacular innovation the Ford management was merely trying to obtain docile labor which it could easily exploit by brutal speeding. John R. Lee, speaking to a predominantly academic audience in 1916, emphatically denied that the new policy was "designed or conceived for the sake of business expedience or advertising," and asserted: "We were perfectly satisfied with what each man was giving us, as far as daily return was concerned." Indeed, so extraordinary had been recent increases in output under mass production methods, and so heavy had become the profits, that nobody had reason to think of sweating the labor force. It is true that greater docility, greater working efficiency, and greater power to pick and choose in hiring men, *followed* the new wage schedule; but the management never gave any evidence of calculating on this, and did not need to do so. Arnold and Faurote simply pointed to a natural result when they wrote that the usual resistance of workers to efficiency measures did not exist in the Highland Park of 1914:

> The Ford high wage does away with all of this inertia and living-force resistance. The top men of all Ford departments know they are expected to make labor-cost reductions. . . . The workingmen are absolutely docile, and it is safe to say that, since the last day of 1912, every single day has seen marked reductions made in the Ford shops labor costs.[69]

Ford and his associates freely declared on many occasions that the high wage policy had turned out to be good business.[70] By this they meant that it had improved the discipline of the workers, given them a more loyal interest in the institution, and raised their personal efficiency through better living standards, all this lifting production. No scientific attempt to evaluate the various causes of rising production was ever made. It was simply assumed that the five-dollar day made its contribution; but to weigh this contribution against those of better management, better materials, or better plant arrangement, was impossible. When the Commission on Industrial Relations pressed the company for information on these points, it was refused on the ground that the several variables could not be disentangled.[71]

What, then, was the actual motivation? Henry Ford correctly summed up most of it when he spoke of "profit sharing and efficiency engineering." With net income of more than $27 million in 1913 and

dividends of well over $5 millions, the management felt that it had to share its wealth; and if huge slices of pudding went to consumers, and other slices to officers, a great slice logically had to go to workers. Just how great? All the demands of efficiency engineering would have been satisfied by Lee's administrative reforms and a moderate new wage increase. "Pete" Martin, responsible for production results, did not wish to go beyond this point. He was hardboiled. Happily, others had a broader vision and keener sense of responsibility. Practical idealism was part of the motive; the practical idealism Ford expressed when he told W. J. Cameron, "Well, you know when you pay men well, you can talk to them."[72]

A violent and futile discussion has raged as to whether the larger credit belongs to Ford or to Couzens. In his later years (1930), Couzens, after long reticence on the subject, spoke vaguely of himself as the originator. After describing a scene at the discharge of some hands which had wrung his heart, he said: "I got converted right there. After forty-eight hours of discussion, Henry Ford agreed to a raise of wages from $2.30 a day to $5 in the hope that such men as we could retain might save something out of the increased wages for any contingency or lay-off in the future."[73] John Dodge testified in 1917: "I understand that Mr. Couzens evolved the idea in the beginning."[74] MacManus describes Couzens as originating the five-dollar figure, and persuading Ford to accept it over the objections of Martin.[75] George Brown, an office employee, relates that after the primary decision, Couzens formed an alliance with Mrs. Ford to convince Ford that the office workers should also get increases.[76]

On the opposite side, the story as we have given it is vouched for by Charles Sorensen, an acute and careful observer who was present at the fateful January conference and has written a careful narrative of it. It is similarly vouched for by W. J. Cameron, who talked with Ford on the subject and has set down his recollections in full. Harold Wills told his son that Ford was the author of the plan. Complete credit is also given to Ford by Joseph Galamb, who knew what was going on at the time, and states: "I don't think that Mr. Couzens cared for the idea of the five-dollar day."[77] But as we have said, this discussion is futile. It is possible that both men favored the plan and worked it out between them. It certainly went out to the world as the policy of both, and both may hence claim credit. The proposal

would probably have been vetoed had Couzens violently opposed it, and could certainly never have been approved without Ford's hearty support. Nor did it really represent a snap decision. A revision of company labor policy had been under way for months, had been discussed by all high executives, and had culminated in Lee's tour and his sweeping administrative reforms.

Ford was quoted later as saying that the management had contemplated the step for some time. "We were on the point of doing it a year ago, and then decided we had better increase our working capital in order to be absolutely sure of our financial independence."[78]

Some credit, too, should probably be given three persons whose influence lay in the background. John R. Lee had brought to labor problems a broad understanding and a humane outlook; an experienced industrialist, he held the respect of Ford and Couzens. Clara Bryant Ford, credited by her husband with "foresighted policy," read letters from Ford employees and their wives, and may have been helpful in moulding Henry Ford's attitudes in humanitarian matters. A New York sculptor to whom Ford sat at this very time, C. S. Pietro, reports him as speaking of her in the warmest terms: "She instilled into his mind, he [Ford] said, those ideals of social justice which he is trying to make practical, and has kept his heart young and fresh and has enabled him to maintain his faith in God and man."[79] And finally, the brilliant young Englishman, Percival Perry, who had made so great a success of the Ford factory at Manchester and of the wide sales organization controlled from the Shaftesbury Avenue offices in London, may well have played an important part in preparing Ford for the decision. When Perry opened the factory in Manchester, he found the ruling wage-rate for unskilled labor to be sixpence-halfpenny an hour for a 56-hour week. This was a starvation wage, on which decent family life was impossible. By systematic investigation, he found that one shilling threepence an hour, or £3 a week, would keep a family properly. He adopted the rule of paying no employee less. It worked admirably; in a happier factory he obtained better production. When in 1912 Ford visited the British Isles, Perry accompanied him to Ireland. Missing the boat at Fishguard, they had to spend the entire day there; and Perry explained to the interested manufacturer his plan of "high wages and straight wages" in complete detail.[80]

8.

Thus the Ford Company, which in 1911 had no labor policy at all, possessed three years later the most advanced labor policy in the world, and was regarded by wage earners from Sydney to Bangkok, from New York to Copenhagen, as a source of hope and inspiration. The celerity of its progress in this field was of a piece with the rapidity of its success in others. Plain people the world over were providing mass consumption for the Model T; engineers the world over were arrested by the Ford techniques of mass production; economists and sociologists the world over were deeply interested in the suggestion of high wages for the masses. The Ford Motor Company was something more than a successful manufacturing enterprise. It was an exemplar, almost miraculous in its swift rise, of forces that were reshaping the world.

to Thomas A. Edison. But cold was no deterrent to men made desperate by family want and excited by dreams of the highest wage paid in the history of American industry. Long before dawn groups were shuffling into Manchester Street; and by seven-thirty ten thousand men, massed about the factory, were displaying a temper that alarmed the police. When employees wearing Ford badges began to push through, the sight of these privileged holders of keys to warmth, food, and security was too much for the shivering unfortunates.[7]

Tempers snapped. Isolated hoots and yells turned into a mob roar. The crowd surged against the gates, hundreds fighting past the helpless guards into the plant. More police, arriving on the run, were unable to restore order. The mob pinned them and the factory guards against the walls, prevented workers from entering, and threatened to break down the doors. When the fire hose was hauled out and waved threateningly (this was before the day of tear gas), the crowd simply yelled in derision. Then somebody barked an order, and the water was poured full force into the front ranks. With the thermometer at nine above zero, this ended the demonstration. Everyone in front of the factory broke for cover. As the mob dissolved, many hurled stones through the multitudinous windows of the plant, while others, boiling over the lunch stands in the neighborhood, left them wrecked and empty.[8]

A little planning might have prevented this explosive disorder. Neither governors nor mayors in the upper Middle West had realized how great was the mass of unemployed within a short journey of Detroit, or how hard they would be to control. While the mob besieged its gates this first week, the Ford Company received 14,000 letters of application. It had to stop all direct hiring for the time, issue an emphatic announcement that nobody would be employed who had not lived for six months in Detroit, and turn recruitment over to the Employers' Association.*

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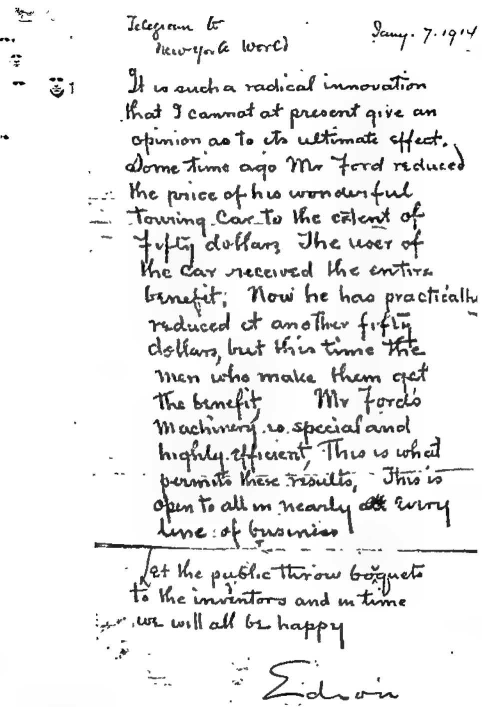
ne shift worked from
shift from midnight
or lunch. Ma'e offic
rked only one shift;
Faurote, op. cit., 35-
Ford officials, were
andwiches, a banana
for five cents more.
idnight shift, which
.)

The first magneto assembly line, Highland Park plant, 1913 or 1914 (Note close spacing of the dozen workmen at the conveyor belt)

Ford Employees in 1911

Top row . Theo Purman, Wm. King, Sol Logan, Fred Collins, Oscar Grade, Harry Hickey, C. W. Avery, Alex Sparks, John Putnam, Paul Neinas Second row: Leo Moss, L. B Robertson, Ed Clemett, Geo Howard, J Miller, E P Hobart, Chas Beebe, Herb Payne, Doctor Mead, Ernie Davis, Wm Ryan, Ed Harper, Archie Tyrell, Carl Emde, "Scotty" Hueglin, Phil Fishback. Third row: Fred Allison, Gus Walter, Otto Tilly, Wm. Carswell, Joe Galamb, Edsel Ford, W. C. White, F L Klingensmith, Fred Diehl, Jim Purdy, Wm Klann, Gus Spengler, Jos. Godette, John Wandersee Front row: Chas Sorensen, P. [illegible] Martin, Gus Degener, Frank Kulick, Henry Ford, C H Wills, Edward Gray, John R Lee, G M. McGregor, Chas Hartner, Chas. Meida

Overhead conveyors carrying wheels, fenders, and running boar
to be attached to the chassis; the Highland Park Plant about 19



Telegram to New York World

Jany. 7. 1914

It is such a radical innovation that I cannot at present give an opinion as to its ultimate effect. Some time ago Mr Ford reduced the price of his wonderful touring Car to the extent of fifty dollars The user of the car received the entire benefit; Now he has practically reduced it another fifty dollars, but this time the men who make them get the benefit, Mr Ford's Machinery is special and highly efficient, This is what permits these results, This is open to all in nearly ~~all~~ every line of business

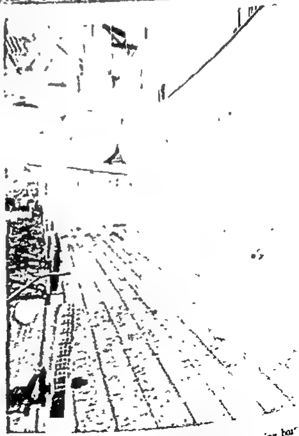
Let the public throw boquets to the inventors and in time we will all be happy

Edison

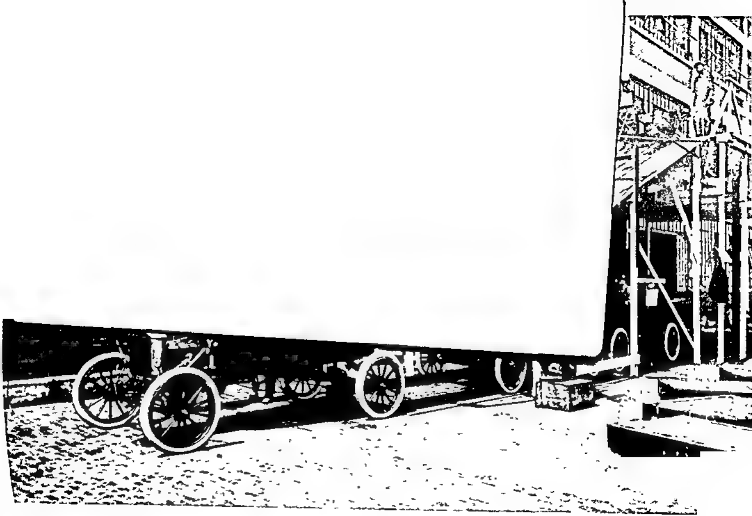
Telegram sent by Thomas A. Edison in response to a request from the New York *World* early in 1914

Ford Employees in 1911

Top row· Theo Purman, Wm. King, Sol Logan, Fred Collins, Oscar Grade, Harry Hickey, C. W Avery, Alex Sparks, John Putnam, Paul Neinas Second row· Leo Moss, L B Robertson, Ed Clemett, Geo Howard, J Miller, E. F Hobart, Chas Beebe, Herb Payne, Doctor Mead, Ernie Davis, Wm Ryan, Ed Harper, Archie Tyrell, Carl Emde, "Scotty" Hueglin, Phil. Fishback Third row: Fred Allison, Gus Walter, Otto Tilly, Wm. Carswell, Joe Galamb, Edsel Ford, W. C White, F. L. Klingensmith, Fred Diehl, Jim Purdy, Wm. Klann, Gus Spengler, Jos Godette, John Wandersee. Front row Chas Sorensen, P E. Martin, Gus Degener, Frank Kulick, Henry Ford, C. H. Wills, Edward Gray, John R. Lee, G. M. McGregor, Chas Hartner, Chas Meida



Overhead conveyors carrying wheels, fenders, and running boar to be attached to the chassis; the Highland Park *Plant* about 19



Dropping the body upon the Model T chassis, Highland Park Plant, 1914 or 1915

increased the minimum hourly wage in 1916 from 34 to 43 cents, and two years later advanced it to 50 cents.[13]

According to Lee, nearly seven employees out of ten at Highland Park qualified for the five-dollar minimum in the first six months, and nearly nine out of ten by the end of 1914. Evidently he meant that they qualified subject to completion of the half-year probationary period—an important condition, for the labor force doubled in the first two years under the plan. The company itself stated that on July 31, 1916, three-fourths of the Highland Park employees (76 per cent) and nearly that fraction of all Ford workers in the country (73 per cent) were on the new wage scale. The plan was extended to branches in the United States and abroad in somewhat diluted form. It became the four-dollar plan (that is, a minimum of four dollars daily, a maximum of five) in American branch assembly plants; while despite original instructions to the contrary, the branches retained the nine-hour day.* Plant managers abroad were authorized to adapt the minimum wage plan to their countries, subject to approval by the home office. At the principal overseas plant, Percival Perry's flourishing Manchester factory, a high wage was already in force.

Women and salaried workers, at first ignored (except where women were the sole support of relatives), were presently brought within the scheme. One reason for believing that Henry Ford was the main author of the five-dollar minimum is the fact that it was originally planned simply for the men in the factory—the force in whom he took a direct interest.

The Highland Park plant at the time had about 250 women workers. A vocal outcry from such feminist leaders as Helen Keller, Anna Howard Shaw, and Mrs. James Lees Laidlaw[14] helped induce the company to include them in the plan (October, 1916). As for the white collar workers who for years had toiled overtime hours under the unsparing eye of Couzens, they at long last received a partial measure of justice. Ford seems never to have felt any real concern (and probably not much respect) for them; Couzens had always believed they should slave as hard as he did, without his special incentives. Now, however, it was a point both of office efficiency and personal pride with Couzens that his men should be given advances commensurate with

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* The branch assembly plants at Kansas City and San Francisco did adopt the eight-hour day for a time, but soon gave it up. The schedule for the branches provided for maximum raises of $1.30 a day, as against the maximum increase of $2.93 granted at Highland Park.

The five-dollar day was actually a misnomer; at the beginning of April, 1914, approximately 200 Ford men got $7 a day, about 1000 got $6 daily, and the remaining 15,000 were getting or would soon get $5.[11] Nor was the new system a profit-sharing plan; it was simply the establishment of a high minimum wage out of profits. On this point Couzens was emphatic, explaining that it was called a profit-sharing plan so that the company could better control it; that is, could reduce the minimum if profits fell, and increase it (as it later did) if they rose. Organized labor has always been suspicious of profit-sharing plans because of their precarious nature; they enable an employer, when profits fall, to cut wages immediately. Sharp variations in pay from company to company within the same industry have also been regarded as objectionable. Union leaders have always preferred an industry-wide increase in wages, to be maintained even if stockholders suffer. Actually labor had no reason to feel critical, for the minimum wage was practically certain to rise.

It was fortunate that the chief administrator of the plan was John R. Lee, as warm-hearted as he was shrewd and suave. One close observer has succinctly characterized him: "The soul of the organization, the champion of the underdog, the man to whom no one ever looked in vain for justice and a square deal. And every time anyone handed him a bouquet for his bigness of heart he tossed it over to Henry, and when there was no one around explained to him what it was all about. And Henry kept the flowers."[12] Two fundamental conditions were promptly attached to the five-dollar plan. One, already noted, was the six months' residence qualification for employment. The second, designed to reward experience and reduce turnover, made a half year of company service a prerequisite to the new minimum wage. Ill-natured observers jumped at the conclusion that the Ford Company meant to hire and fire rapidly to avoid paying the five-dollar rate. This would have been foolish, injuring the company more than the worker; it would have been out of harmony with the whole liberal pattern of Ford labor policies at the time; and it would have been alien to the character of Ford, Couzens, and above all, John R. Lee. The half-year service rule was honestly framed and applied. The chief objection developed later, for when the World War brought inflation, new employees found it difficult to live on the probationary wage. A survey showed that many were borrowing. The company therefore

ning the good will of the American people, the innovation had been worth more.

One factor in the increased productivity was certainly the cooperative attitude created among workers by the plan. For the first time since the early days of Model T, Ford workers felt a sense of personal identification with a great hopeful enterprise, managed in their interest as well as that of the owners. A spirit of comradeship spread throughout the factory. In the old days the Ford management had demanded docility, and had gotten it at the cost of a turnover rate that sometimes approached 400 per cent a year—at the cost, too, of subtler forms of protest. Now they got cooperation, and often enthusiastic cooperation. Once the Ford factory, like others, had been called "The House of Correction"; now it was temporarily called "The House of Good Feeling."[16]

In 1914, and for some years later, men were proud of being Ford employees; they gained personal prestige from their connection with a factory so efficiently and liberally managed. They belonged to an industrial élite. One token of this pride was the wearing of Ford work-badges to dances and other social affairs. To be sure, workers were never coddled. After being rather gently broken in, new hands suspected of idling might be sent to the stern toil of the foundry; and if they flinched, asking a clerical post in the front office or a light job on the magneto assembly, they might find themselves discharged.[17] The work was hard, the pace inexorable, the pressure for ever-better production insistent. "The top men of all Ford departments," writes a keen observer, "know that they are expected to make labor-cost reductions, that tomorrow must always better today."[18] But the old adage that hard work never hurt anyone possessed great truth as applied to an establishment in which men felt that they had a generous wage, a measure of real partnership, and a future.

Any detailed analysis of the effect of the five-dollar minimum upon working morale is difficult, for it was inextricably intertwined with other innovations of the same date. The policy of forbidding discharge by foremen and trying men in various departments to test their aptitudes; the sick leave allowances soon introduced; the new savings and loan association; the English School for immigrants opened in 1914 and the technical school which Henry Ford, against opposition from other officers, instituted in 1916—all this had an effect upon the spirit

of the shop. The various welfare measures, from better medical care for the injured to an extra five minutes for lunch, must be lumped together. Weighing their effects after two years, the Educational Department in 1916 declared that the whole set of innovations, including profit sharing, a brighter factory environment, and educational work, when regarded from the cold-blooded business standpoint, was "the very best investment" the Ford Company ever made.[19]

Henry Ford himself later wrote: "The payment of five dollars a day for an eight hour day was one of the finest cost-cutting moves we ever made."[20] Absenteeism ordinarily cut the working force of automobile plants at this period by three to four per cent a day, but in the Ford factory in 1916 it had fallen to about two per cent.[21] Turnover rates, which had so strikingly declined after the first labor reforms, remained low throughout the war period.[22]

The five-dollar minimum, for all the applause it received, failed to inspire much early imitation. Apparently the one notable company in the automotive industry hastening to introduce a similar plan was the Timken Axle Company of Akron, which asked the advice of Ford executives in establishing a profit sharing plan, but abandoned it after one year.[23] Numerous automobile companies did follow Ford, to be sure, in adopting the eight-hour day. This, however, was primarily to make possible three eight-hour shifts, such continuous use of factory facilities being measurably more efficient under the pressure of heavy demand which accompanied the war. Machinists throughout the country took advantage of the war-time labor shortage, moreover, to gain the eight-hour day.[24] By 1920 more than half of Detroit's industrial workers were on a 48-hour week.[25]

The Ford plan of course benefited all automobile companies in the Detroit area by swelling the reservoir of available labor there. Thousands of unemployed men moved to the city. Even after the company announced that it would accept no applicants from out of town, the stream flowed on—for the unemployed had nothing to lose; in six months they could meet the Ford plant's residential qualification; and the automotive industry was expanding more rapidly than others. Normally, the effect of this influx, and of the widespread unemployment until the war boom grew pronounced, would have been to drive down wages in other factories. The Ford scheme may well have done something to prevent this; after it was announced, many employers would

have been ashamed to take advantage of the plethoric labor market, and some may even have felt a moral compulsion to advance wages a little. But we do not know. No state or federal statistics are available, and the Employers' Association has no guiding material in its archives.

Had it not been for Serajevo and the European explosion, fuller and clearer evidence on the workings of the five-dollar minimum could have been accumulated. The war, however, introduced so many abnormal factors affecting wages, hours, living costs, and industrial morale, that the isolation of a single element for laboratory study became impossible. Inflation, rising demand for labor, and wage increases soon made the five-dollar or even seven-dollar wage seem much less spectacular than when it was introduced. Indeed, by the time America entered the conflict in 1917 a five-dollar wage in munitions plants was commonplace. During the war skilled workers in certain other Detroit factories achieved a higher average pay than that in the heavily mechanized Ford plant. Nevertheless, for a brief period the five-dollar plan did irradiate the American labor scene with a light that cheered millions and made industry seem kindlier and more helpful. It was not quickly forgotten. Profit sharing had been tried before in numerous establishments; many varieties of the high minimum wage have been tried since; the government itself moved in New Deal days to put a solid floor under wages. But no other scheme ever produced such a world-wide sensation as the "Five-Dollar Day" of 1914, and probably none ever sent such a thrill through the breasts of millions of workers all over the globe.

3.

To administer the five-dollar plan and ensure that the higher wage would serve constructive and not pernicious ends, the company at once created what was called the Sociological Department. John R. Lee, its head and vitalizing spirit, was responsible for the high initial character of its work. "If it had not been for Mr. Lee," wrote his successor, the Rev. Dr. Samuel S. Marquis, "I am inclined to think that the sociological work of the Ford Motor Company would have taken its course along lower and conventional lines. He is a man of ideas and ideals. He had a keen sense of justice and a sympathy with men in trouble that leads to an understanding of their problems. He has an

unbounded faith in men, particularly in the 'down and outs,' without which no man can do constructive work. Under his guidance the department put a soul into the company."[26]

A century earlier Robert Owen's model factory village of New Lanark, and his combination of good wages with a systematic betterment of the education, health, and general living conditions of the workers, had been famous throughout the civilized world. Probably Ford, Couzens, and even John R. Lee knew nothing about Owen; but not since New Lanark had a bolder effort been made to raise the standards of working class life than that now instituted by the Ford Company. The original five-dollar announcement had stipulated that men below twenty-two would have to prove that they were "sober, saving, steady, industrious." But what of older employees as well? Would they not dissipate their money? Immigrants from the slums of Naples and hamlets of Croatia, farm hands from Ohio and Wisconsin, Negroes from Georgia—would they not throw away recklessly the dollars burning in their pockets? Detroit's popular versifier Edgar A. Guest composed a warning ditty about Giuseppe Tomassi, who with white collar, silk hat, and walking-stick, a Ford badge on his coat lapel, took his Rosa, gay in satin and lace, for a Sunday stroll:

> He smok' da cigar weeth da beega da band,
>   Da "three-for-da-quart" ees da kind;
> Da diamond dat flash from da back of hees hand,
>   Eez da beegest Giuseppe could find. . . .
> For Giuseppe, he work at da Ford.[27]

This pioneering effort of the Ford Motor Company (for no other large industrial plant in the area had a comparable welfare department) gained significance from the time and place. Immigration was at flood-tide. More than 1,400,000 men, women, and children poured into the United States during the fiscal year 1913–14.[28] Four-fifths of them came from Italy, Austria-Hungary, and Russia. These immigrants, usually with no capital but their muscle, flocked to the large cities, living in colonies where language, religion, customs, and living standards shut them off from the native stock. The map of any great industrial center, colored by nationalities, would have more stripes than a zebra and more spots than a leopard. Dappled by a "little Italy," a "little Poland," a "little Hungary," a "little Lithuania," such cities found an ignorant, bewildered population bursting its tenements and

covering its open lots with shacks. Informed Americans were familiar with the *Pittsburgh Survey,* whose volumes combined a story of savage exploitation of immigrant labor (nearly two-thirds of the 23,337 workers in the Carnegie steel works in 1907 were immigrants) with revelations of the squalid living habits of many alien groups. They needed both protection and education. For years the problems of vice, crime, sanitation, housing, and Americanization in the big industrial communities had grown steadily more exigent.

Detroit, which had almost reached the half-million mark in 1910 with 465,766 people, and was rapidly stretching up toward the million it reached in 1920, had its alien colonies of Slavs, Magyars, and Italians, its crowded slums, its illiterate and unassimilated masses. Many immigrant families, the father, mother, and children all working, lived in cramped rooms, ate poor food, and saved every cent to return affluent to their old homes. In cheap rooming houses three men used the same bed in eight-hour shifts. Under a police department so corrupt that James Couzens finally had to be called in to reform it, the city was full of saloons, gambling dens, and disorderly houses. All automobile factories were largely staffed with immigrants. At the Ford plant the foundry workers, common laborers, drill press men, grinder operators, and other unskilled or semi-skilled hands were likely to be Russians, Poles, Croats, Hungarians, or Italians; only the skilled employees were American, British, and German stock.[29] On the morrow of the five-dollar announcement a sociologist at the University of Michigan commented that factory workers did not need more money so much as instruction in using their money:

> The great trouble with the vast majority of our laborers is that they do not know how to spend their wage judiciously. If they receive $5 a day, the likelihood is in the majority of cases that it will all be spent when the next pay day comes, and there will be no more left in the fall to tide over a hard winter, or laid away to bridge a sick spell, than there was when the laborer was receiving $2.50 a day. . . . What the sociologist would like to know is how will that $10,000,000 be spent. I suppose there are in the Ford plants several thousand foreigners who are in this country for the sole purpose of accumulating enough money to go back to their native country. . . .
>
> Will those families which can now spend only $10 for rent, with their increased income spend $15 or $18 and get more light, fresh air, room, and enjoyment in home life? Or will they live still in the same dirt and squalor and continue to take in boarders and live in crowded houses, in order to spend more money in a way that will not benefit them or society?[30]

It was doubtless to avoid the unctuously condescending term "welfare" that John R. Lee named his new agency the sociological department. Under great pressure of time he worked out a practical plan by which the company might establish friendly and mutually respectful relations with its employees, and recruited a staff of thirty, which he expanded to about 100 by the end of the year, and eventually to 150. He had the hearty cooperation of Couzens, who possessed his charitable side and always wished to see money shrewdly spent, and of Ford, who in one aspect of his many-sided personality took a keen interest in the rehabilitation of men. While Ford never believed in charity, he did believe in helping men to help themselves, and was convinced that nobody could raise himself far as long as his home, personal life, and environment were bad.[31] Lee, with his growing staff, carried on a continuous work of investigation, counsel, and practical instruction among the army of Highland Park employees; an army that reached a yearly average of 12,880 in 1914, of 18,892 in 1915, and of 32,702 in 1916.[32]

Each investigator, equipped with a car, a driver, and an interpreter, was assigned a district in Detroit, mapped to contain a due proportion of Ford workers and if possible a limited number of language groups. The subjects for inquiry made up a formidable list. Naturally, each worker was expected to furnish information on his marital status, the number and ages of his dependents, and his nationality, religion, and (if alien) prospects of citizenship. In addition, light was sought on his economic position. Did he own his home? If so, how large was the mortgage? If he rented a domicile, what did he pay? Was he in debt, and to whom? How much money had he saved, and where did he keep it? Did he carry life insurance, and at what premiums? His social outlook and mode of living also came under scrutiny. His health? His doctor? His recreations? The investigator meanwhile looked about sharply, if unobtrusively, so that he could report on "habits," "home condition," and "neighborhood." Before he left a given family, he knew whether its diet was adequate; whether it took in boarders—an evil practise which he was to discourage; and whether money was being sent abroad. All this information and more was placed on blue and white forms. The Sociological Department was nothing if not thorough.*

* The word "sociological," invented by Herbert Spencer, then stood at an altitude of repu-

Dr. S. S. Marquis, the able and enlightened Episcopalian clergyman who presently succeeded Lee as head of the department, insists that it was fraternal, not paternal, that its investigators were kindly, not inquisitorial, and that its advice was given and taken in good part. In great part this was doubtless true. Other observers believed that many workers resented the questionnaires. Comments of job-seekers at the Labor Bureau of the Employers' Association (many of them discharged Ford employees, to be sure, and hence prejudiced witnesses) revealed an undercurrent of discontent.[33] Doubtless the spectacle of an earnest inquirer writing down an array of facts on his blue form aroused conflicting emotions in many breasts. The investigators, who were recruited from the plant (a few outsiders were hired, including Clara Ford's niece Katherine Bryant) were asked to throw "a deep, personal interest" into every visit.[34] Sometimes this was cordial and helpful. Sometimes it was tinged with suspicion; the mere word of an employee that he was married was not taken as sufficient, and the agents were instructed to use some ingenuity in getting this information *positively*. The inquiry necessarily had to go beneath the surface. Branch managers were instructed, for example, to be vigilant and to make sure "beyond the shadow of a doubt that the money is paid to those deserving, and to no others."[35]

As in all such inspections, including those made by city and state agencies and by charitable organizations, much depended on the personality of the investigator.

On the basis of the inquiries, all Ford employees were classified in four groups: those fully qualified; those excluded under the basic rules upon age, length of service, and so on; those disqualified by bad personal habits; and those debarred by unsatisfactory home conditions allied with improper habits. Though a moderate resort to liquor was not forbidden, "excessive use" came under the ban.[*] So did gambling.

[illegible] that Graham Wallas in *The Great Society* dealt [illegible] created by modern busi- [illegible] 1906), Benjamin Kidd, [illegible] merous new avenues of [illegible] ed sociology had a large

[*] Keith Sward in his book on Ford erroneously writes (p. 59) that any use of liquor was forbidden. He is also erroneous in stating that the specified percentages of "profits" were permanently withheld from workers awaiting qualification. His reference to Levin's article on the subject does not substantiate this assertion. Levin obviously relies on Lee's exposition of the system, and Lee makes it clear that profits were impounded only for the period during which the worker failed to qualify—in most instances short.

So did "any malicious practise derogatory to good physical manhood or moral character." A household dirty, frowzy, and comfortless; an unwholesome diet; a destruction of family privacy by boarders; an excessive expenditure on foreign relatives—these were among the reasons for condemnation.

Any worker disqualified for the five-dollar minimum on such grounds was placed on probation, and given close attention. If he changed his habits or home conditions within thirty days he received all the sums withheld; if he took sixty days, he got three-fourths of the sum impounded; if ninety days, only sixty per cent; if five months, only one-fourth. After six months in purgatory without sign of reformation, the delinquent was cast into the limbo of Detroit, and his unearned "profits" were used for charity. Even so, when a black sheep returned to the fold with bleats of repentance, he was usually given another chance.

4.

Were the standards set unreasonably high? Good evidence that they were not appears in the fact that within two years nine-tenths of the working force qualified for the five-dollar minimum, in a period during which their total number more than doubled.[36] Investigators were forewarned that reformation of unsatisfactory employees would require vast patience and intensive work, and assured that Henry Ford and his associates thought that no effort could be more important.[37] They unquestionably put a fervent energy into the assignment, pressing the workers to open savings accounts, improve their houses, and get better food and clothing. Although Lee is emphatic in his assertion that no employee was urged "against his will,"[illegible] the men were certainly very strongly urged—and if they failed to respond, might be deprived of benefits, and ultimately even discharged.* In dealing with

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* In a letter to Boyd Fisher of the Detroit Chamber of Commerce on June 24, 1914 (Acces-
sion 62, [illegible] went into
the quest[illegible] a report
on the F[illegible] red it to
Ford offi[illegible] re a case
that an investigator has handled for us where the men have been FORCED, as you say, to do
certain things, nevertheless [illegible] whole work, as planned
[illegible] y influenced
[illegible] suggestion
[illegible] true by the
[illegible] they have
not heretofore realized and accomplished.
"No man is discharged or changed in status or relationship with the company because he

many personal problems, such as intemperance or marital discord, the sociological department often called in the employee's priest or minister with happy effect.

The conditions imposed, however, appear reasonable; all could be met without more than temporary hardship; they were for the good of the workers in the long run, and the good of the Detroit area. The sociological department was not concerned with imposing an arbitrary set of police regulations; it was concerned simply that the higher income of the workers should result in a better standard of life. No doubt the company policy had its dangers and faults; but the real question is whether it was better than a laissez-faire course, for if the principle of guidance was adopted it had to be in about the form employed. To that question the answer is clear.

Certainly the Americanization work was of great utility. As Theodore Roosevelt kept insisting in these years, the fundamental step in Americanization was acceptance of the English tongue. The company established its English school in May, 1914, to assist the multitude of immigrant hands who knew no English and lived in colonies where it was seldom heard. Attendance was mandatory, and those who did not make a reasonable effort to learn the language were presently discharged. A Dr. Roberts, proficient in the Berlitz method, trained instructors from the supervisory and office force who volunteered their services without pay. The system, based upon group recitations, seems to have been very successful with most immigrant groups. A worker attended classes before or after his shift for six or eight months, then receiving a printed diploma at graduation exercises conducted with proper ceremony. In preparing the subject-matter for the lessons, Dr. Roberts included material explaining the system used in the factory, and inculcating "a little Ford patriotism." By the end of 1916, some 2700 students were being instructed by 163 volunteer teachers, and

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does not speak English or is not naturalized, but the advantage to be derived from both are [illegible] to learn the English [illegible]

[illegible] ant," cited in Note [illegible] seemed to be "a [illegible] period was given [illegible] "requalified" in 30 [illegible] end of six months [illegible] of the Ford Motor [illegible] to only in extreme [illegible] justment.

the courses had been expanded to give about 300 Americans a training in mathematics, psychology, and public speaking.[39]

The program served several purposes in which the company was interested. It was absolutely necessary, in the long run, that all employees be able to take orders in English. This was a matter of shop efficiency. In the second place, the welfare policy encouraged workers to become naturalized citizens, and for naturalization a knowledge of the language was indispensable. Federal authorities accepted a graduate of the English School as qualified for his first papers without further examination. Finally, while being taught English the workers could be indoctrinated in the ideals of the sociological department; and those who learned to read English-language newspapers and magazines (including the advertisements) at once took a long step toward normal American standards of life. When men learned English, too, they usually lost their old tendency to agglomerate in foreign-language colonies, and the gap between the first and second generations in the new land was narrowed.[*]

An indication of the success of the company's Americanization program lies in the fact that while in 1914 two-thirds of the employees were aliens, two years later more than half of the doubled force were citizens. The force of this example in helping the general Detroit melting-pot boil a little faster cannot be overlooked.[40]

Proper housing for company employees was from the outset a primary concern of the sociological department. The company wanted no Ford slums. During the first three years of its activity decent housing was not excessively scarce in Detroit, and many workers were persuaded to move into better quarters—in fact, 13,000 families moved during the first year. In 1914 investigators found almost twenty per cent of them living in "poor" homes; two years later the proportion had fallen to two per cent.[41] Between these dates the number living in "poor neighborhoods" fell from twenty per cent to about one per cent. Ford workers at the beginning of 1914 were buying homes valued at three and a quarter million dollars; two years later the valuation

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[*] Professional exploiters of foreign-language groups were numerous. "We have actually found in Detroit petty empires existing," wrote Lee in his article on "The So-Called Profit Sharing System." When a group of Rumanians, for example, arrived in Detroit, someone met them at the station. He "confiscates the party, so to speak, persuades them to live in quarters selected for them, to buy their merchandise in markets other than their own choosing, and to live unto themselves and apart from the wholesome environment of the city, so that the instigators of all this may benefit through rentals and large profits on food, wearing apparel, etc." P. 305.

exceeded twenty millions. In connection with housing, it is to be noted that the proportion of married men over the same period rose from about 55 to about 70 per cent. More men could afford marriage—and presumably they lived in greater comfort afterward.[42] With American entry into the World War in 1917, however, the problem became decidedly more intricate, for war orders brought a terrific congestion in Detroit at the very time that new construction ceased. The difficulty then was to get workers under any kind of rooftree in any kind of neighborhood. As Marquis frankly said, it was impossible to help men better their housing. By 1920 many workers in Detroit were living in habitations hardly fit for cattle, and some on the outskirts were sheltered in tents.[43]

In discouraging the practise of taking boarders, the company felt some sensitiveness to the charge of being unduly paternalistic and meddlesome. In the fall of 1914 it published an account of its experience with one workman who failed to qualify for the minimum wage because his wife had eighteen boarders. An investigator found that the couple, neither of whom spoke English, with five young children, had rented a large house for $80 a month, and were realizing a gross income of more than $300 monthly. This and the husband's factory earnings had enabled them to save $890. While the mother toiled from four in the morning till late at night, the children ran loose and became a neighborhood scourge. Questioned by a committee of the sociological department, the hand adduced his bank account and his wife's hard work as sufficient qualifications for the new wage. But he was disapproved and his case was given special attention:

> . . . upon investigation it was found that this man had been born and reared in an atmosphere that knew nothing of pleasure, void of comfort and where work seemed to be the only aim, object, and indulgence of the human being. The man was brought into the Ford School and taught the English language. Here he responded readily. He was given some ideas of American ways and customs and on two or three occasions, at the Company's expense, he was taken to see what other men, employees in the Ford factory and born under similar circumstances, had done for themselves and families. He was finally persuaded to invest a part of his savings in a house on the outskirts of the city and about fifteen minutes' walk from the factory.

After three months he was put "on profits," and an investigator found the family life transformed. His wife exclaimed with feeling:

"Never knew what things so good in this world there was like this before!"[44] It can hardly be doubted that thousands of Ford families in these years would have echoed the sentiment.

An emphasis on need ran as a silver thread through the whole fabric of Ford labor policies in this period. The new wage schedule favored the least skilled and theretofore lowest paid workers. The services of the sociological department were also heavily weighted in favor of the deserving needy. The educational system tended in the same direction; when the Henry Ford Trade School was established in 1916, for example, acceptance of students was based largely on need. It is unfortunate that the records of the sociological department were nearly all destroyed, so that its varied activities can be but imperfectly traced.*

The question whether the powers and policies of its agents in the branches paralleled those of the Highland Park office cannot now be answered. An exchange of correspondence between the Cincinnati Branch Manager and E. G. Liebold in the spring of 1914 shows that the employment manager there acted as sociological investigator.[45] Even in the branches, however, the criterion of need was potent. Our investigator, wrote the manager, "passes on all applications for positions, in order that we may not only secure the most desirable help possible, but at the same time give employment to those most in need, everything else being equal."

In combination, the new wage and the activities of the sociological department did much to lift men out of need. Living costs had been steadily rising in the United States since 1907, reaching a peak in 1913.[46] It had been impossible for the workingman with a family on a wage of $2 to $2.50 a day (say $600 to $750 a year) to save anything. With a wage of $5 or $6 (say $1500 to $1800 a year) he could save a good deal. When data collected at the beginning of 1916 were compared with materials gathered in the original investigation of employees beginning two years earlier, it appeared that the property of the average Ford employee in bank accounts and real estate equities had risen during that period from $196 to about $750. This figure did not include savings embodied in durable goods, nor in such intangible investments as the better education of children. Nor did the figures fully reflect the effect of the five-dollar wage upon the property of recipients even in the two limited categories named; for the average

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* No doubt these records were considered in large part confidential.

included many workers who (because of the doubling of the labor force and the six months' service rule) had participated in the plan for less than two years.

Indeed, the figures given may state less than half the real saving achieved. A typical unskilled worker, receiving $2.66 a day as his share of profits, would in two years have earned an additional $1500–$1600. It seems safe to say that this typical worker had saved nearly half of this amount; a fact which casts a sardonic light on the dismal prophecies of those who had feared for the moral fiber of men so suddenly benefited in 1914.

One aspect of the company's concern for the needy deserves special notice. Henry Ford, as Dr. Marquis remarks, had a special interest in giving the crippled and handicapped a chance to work.* When the five-dollar plan went into operation, an order was issued to the employment office that no job-hunter should be rejected on account of his physical condition unless he was suffering from a contagious disease, and that no one should be discharged for physical disability. When due publicity was given this rule, a flood of applications poured in from people who had found it hard to get work anywhere else.[47] In order to place as many handicapped persons as possible in positions where they would perform as good service as the able-bodied, the employment department was supplied with detailed descriptions of every type of job in the plant—7882 in all; the applicant's capacities, revealed by a thorough physical examination, could then be compared with the requirements. Usually a suitable job could be found for almost any handicapped employee—if not at once, as soon as a vacancy occurred.

Many observers had lifted incredulous hands when they heard of this policy. But it worked. When America entered the First World War, the company was employing more than 1700 cripples, and between 4000 and 5000 others partially disabled by disease—nearly all men who would be rejected by industry in general. After the war it agreed to take a thousand handicapped veterans as fast as they emerged from the hospitals. In 1919, after five years' trial of the policy, the company employed 9563 persons with some kind of handicap. One had lost

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* In Arnold and Faurote's book, the able head surgeon, Dr. J. E. Mead, quotes Henry Ford as saying: "We must all live. If a man can make himself of any use at all, put him on, give him his chance, and if he tries to do the right thing we can find a living for him, anyway." P. 42.

both hands; four both legs or feet; four more were totally blind; 123 had lost one hand or arm; 460 had only one good eye; 37 were deaf and dumb; 60 were epileptics; 1560 had hernias. Even men with mental illnesses were given safe jobs. Up to that time, according to the head of the Ford medical department, it was actually true that not a single worker had been discharged because of physical disability. Anyone incapacitated by illness or accident was granted leave of absence and told that his job would be waiting for him. Employees with inactive tuberculosis were usually assigned to the carpenter shop or lumber yard; those with active tuberculosis were sent to a special building where they were isolated from other workers, and special conditions thought suitable to their ailment were maintained.[48]

The company insisted that this was not charity; that the men earned the standard wage paid them; and that by way of gratitude they often did better than other hands. Marquis tells of a totally blind man hired and set to work. A few days later his foreman brought two able-bodied workers to the employment manager. "Here," he said, "take these men and transfer them to some other department. I don't need them. That blind man you gave me the other day is doing their work and his, too, and they are only in his way. And what's more he keeps singing all the time he's working!" The blind workman, a former piano tuner, possessed exceptional delicacy and quickness of touch. In 1918 the company experimented with the policy of giving hospitalized employees some very light work, such as screwing nuts on small bolts. The work was probably a relief from boredom as well as from worry about next month's rent. The men enjoyed it, asked for more,—and produced twenty per cent more work than the hands regularly assigned such tasks!*

A twin employment policy authorized the hiring of a fairly large number of former convicts—another group which Henry Ford was always anxious to rehabilitate. Dr. Marquis testified in 1920 that from

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* This innovation, like other features of the sociological department's work, inspired malicious detraction by ignorant critics who alleged that the company's use of bedridden men was evidence of miserliness if not of some evil intent. It was giving the hospitalized men work, they alleged, to save the workmen's compensation it would otherwise have to pay. Frightful indeed! Ignore the fact that the employee's regular pay was three or four times workmen's compensation payments; forget the fact that giving patients constructive work to do is medically sound; brush aside the fact that the bedridden patients liked the work so much that they exceeded normal production by one-fifth—the company profited, and was therefore wicked! A great deal of this sort of logic characterized the criticism of the five-dollar plan and the sociological department. The sober fact is that these ideas were as fundamentally sound as the idea of the low-priced standardized car, the idea of steady price reductions, and the idea of mass production.

400 to 600 were usually to be found on the Ford Company payroll. Of course their past was treated confidentially. Many came straight from prison, sent on parole by an arrangement between courts and penitentiary officials on one side, the Ford Company on the other. Here, too, the policy worked; and here, too, detraction wagged its tongue, hinting that Henry Ford had a depraved affinity for criminals.* Only the head of the sociological department and a special adviser knew the identities of men in this special category.[49] Some time after he left the company John R. Lee wrote that much study and effort was given this group, "and a great many of the men were employed and helped to an extraordinary degree." He added that he could furnish material for several volumes on this interesting point. Unfortunately he never did!—and the secrecy very properly thrown about the matter makes any detailed treatment of it today impossible.[50]

It was indeed true that for these years 1914–20 the company, as Dr. Marquis wrote, had a soul. When employees fell ill and stayed in the hospital until their savings were exhausted, the company paid their bills and made a half-pay weekly allowance to the family. In some instances this support was extended for as long as two years.[51]

5.

The disciplinary procedures of the company at this period remained mild. As we have seen, the labor policies adopted in 1913 deprived line foremen of their power both of fixing wage rates and of discharging men. Discharge, treated after that date as a final resort in labor management, was entrusted to the employment department. After a time, about 1917, Dr. Marquis was made a court of final appeal in most cases.[52] When a foreman suspended a worker from his job, it was for the employment department and Dr. Marquis to decide whether the employee should be dropped or transferred to another area. Every effort was made to find a department in which he could justify himself. Even before the five-dollar announcement, as we have noted, the discharge rate had fallen precipitously. After that announcement it dropped to levels unprecedented in the large automotive factories; in 1915 only 28 men were finally discharged—as against 776 in the single month of December, 1912, the worst in company history.[53] Much of

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* When this malicious statement appeared in the writings of the ineffable Harry Bennett, the late Malcolm Bingay of the Detroit *Free Press* stated the facts fairly and administered due castigation.

this drop in the discharge rate, of course, was attributable not to the indulgence of the management, but to the "instant and unquestioning obedience" (Arnold and Faurote's phrase) of men anxious not to lose their five-dollar pay.

Transfer could obviously be used as a form of discipline, and seems at times to have been employed as a punitive measure. Arnold and Faurote describe how two core-makers were once caught fighting in the foundry. One was sent to the cupola-charging stage for a week, and the other to the cylinder shake-out gang, jobs so arduous that they would be happy to return to their benches and keep the peace thereafter.[54] However, certain stubborn employees were so recalcitrant —even after punishment by transfer—as to constitute a sore problem. Klingensmith raised the question late in 1916 of branch workers "who had been given every possible chance to make good and who still refused to straighten up and show a desire to improve their condition, and who were constantly finding fault with their treatment by the Company. . . ."[55] Lee explained that this difficulty had arisen at Highland Park and been met there—but unfortunately his exposition of the procedure used was not preserved. He added that it was not impossible, in spite of the general opinion in the home office and branches, to discharge female workers.

The twin specters of absenteeism and tardiness, encountered in all employments at all times and places, fell to the Sociological Department for exorcism. As for absenteeism, daily lists covering the previous twenty-four hours were soon prepared by the employment department and given to investigators for an immediate check. Under mass-production methods, lateness might dislocate a whole line. Men without adequate excuses were made to understand that imperfect cooperation would mean discharge. As to tardiness, a man found late for the third time in a year was haled before "a fair and impartial court" in his department. If it appeared that he was at fault, he was fined from $10 to $25; on his next pay day he was taken to some needy home; and he was made to hand over the stipulated amount. This, said the *Ford Times*, punished him, taught him the pleasure of giving, and helped the necessitous.[56]

The labor rules of October, 1913, as we have seen, provided for regular wage increases; but no attention was given to promotion to better jobs until Dr. Marquis raised the question in 1916. Men of exceptional

ability, he complained, were kept in routine posts to maintain the high performance record of their department. Factory efficiency would be served by promotion to more difficult jobs; nobody should have to think of his employment as a dead end. Inferior hands did not mind monotonous work—some resisted a transfer; but superior workmen found it deadening. This problem was not squarely faced, however, until just after the war, when an experimental promotion plan was introduced into four large departments.[57]

Meanwhile, however, the more exigent problem of fitting employees to jobs for which they had special qualifications had been promptly attacked. Forms were distributed in 1914 called "Better Advantage Notice";[58] workers were asked to fill in the facts on their skills, and the employment department classified the information. When experts in some line were wanted, the file supplied them. Henry Ford once wanted a watchmaker; a Swiss workman was taken from his drill press. Since the five-dollar plan had attracted hundreds of skilled mechanics who seized any job simply to get on the payroll, this reclassification was essential to an economic allocation of labor. For a time workers were granted frequent transfers to help them find the place they liked best. Abuses led to a reform of procedure in 1916 under a new rule: "It shall be understood with each employee when put to work that no employee shall be transferred more than three times during the period of his employment with the Company at his own request."[illegible] Some departments of course insisted on thoroughly trained and proven men. The toolmakers, metal-pattern makers, and above all the designers in the experimental room had to be masters of their crafts before they entered the door. But others could be quickly trained. The foundry superintendent declared that if a raw immigrant could not be made a first-class molder of one piece in three days, he could never be made anything.[60]

The Ford Motor Company disclaimed any desire to place a shining example of employment methods before industry.[61] The general picture of its discipline and procedure in these years, nevertheless, is that of an exceptionally enlightened and benevolent administration. Some indications appear that in 1914–15 it was even too mild to control the rough irresponsible elements in the shop. In the fall of 1916 the management tightened some rules and admonished the supervisory staff to be vigilant in maintaining them. "It is the consensus of opinion,"

the executive committee declared, "that a little decisive exercise of common sense in this way will be beneficial to the organization; that there is too much bluffing and feigning of sickness and physical incapacity throughout the shop and too little regard for obedience to rules and regulations; that fair play and justice is demanded as much on the part of employees as on the Company's part, and that men who have been put on easy jobs for the asking, rather than because of their real physical needs, be put back again into productive positions."[62] In a great factory, as in an army, severity is sometimes needed.

6.

The growth of industry, the concentration of population in cities, the swelling flood of immigration, and the uneven distribution of wealth had created in the America of Theodore Roosevelt and Woodrow Wilson problems which a nation still committed to laissez-faire principles and distrustful of government intervention found it difficult to solve. Most manufacturing enterprises cared nothing about the social consequences of their policies. The steel mills of Pennsylvania, the textile factories of New England, the packing houses of Chicago, hired and fired masses of workers, paid low wages, let immigrants house themselves as they pleased, and fought unionization without thought of the community interest. The textile strikes at Lawrence and Paterson, the mining troubles in Idaho, Colorado, and Michigan, the fight for the protocol in the New York garment trade, the sporadic railroad stoppages, all revealed a widespread insensibility on the part of capital to changing standards. Social surveys in Cleveland and Baltimore, in Springfield, Ill., and Topeka, following the epochal Pittsburgh survey, threw a searchlight on festering sores—slums, vice, unsanitary living conditions, neglect of children, criminality, graft—which shocked intelligent people more than the old disclosures of the muckrakers.

One broad aspect of social political progressivism was a movement to meet these problems with scientific weapons. City planning schemes, the creation of municipal playgrounds and recreation centers, adult education work among immigrants, juvenile courts and child labor laws, model housing, recreation surveys, drives against legalized prostitution, and the growth of settlement houses testified to the rise of a new social conscience. It is as part of this broad stream of effort that

we can best view the new labor regulations, the five-dollar plan, and the work of the sociological department of the Ford Motor Company. The factory in these years of swift expansion from 12,000 to nearly 33,000 workers might have been content to pay ordinary wages, fight ordinary labor battles, and thus join other automotive plants in fostering the growth of slums already too large. It was much to the credit of John R. Lee, James Couzens, and Henry Ford—the younger, more idealistic Henry Ford of this era—that they took a different attitude. They had caught the spirit of the new progressive impulse. They stood up to battle against the slum and all it represented.

The enlightened new labor rules, the five-dollar minimum, and the struggle of the Sociological Department to raise living standards, constituted, despite inescapable shortcomings, a lustrous chapter in the history of the company and a memorable page in the record of American industry. They should have inspired more imitation by other great business enterprises than they did. The spirit they represented should have taken deeper root in the Ford Company than it did. Unfortunately, ideals of social justice and the square deal as yet had little real strength in American industrial circles; the war, introducing special preoccupations, cut short the whole progressive movement; and after the war the country was to suffer a wave of conservative reaction. Henry Ford, according to Lee, believed that his whole labor system was on trial with public opinion. He was unquestionably deeply hurt by the gibes, sneers, and cynical criticism it encountered in various quarters.[63] But the precarious character of this enlightened labor era in Ford Company history was largely attributable to emerging elements in company administration and in Henry Ford's character at which we must now look.

XXII

RISING DANGERS

In the terrible year 1916—the year in which the Somme offensive cost a million casualties and the Russian campaign in Galicia one and a half million—the United States, rich with war profits, still hoped to stay clear of the European holocaust. Aided by the slogan, "He kept us out of war," Wilson won his decisive plurality over Charles E. Hughes. Along with most other industries, the automotive factories were booming. In the twelve months ending July 31, 1916, the Ford Motor Company made just over a half million cars, sold nearly all of them at $440, and made profits of nearly sixty millions.[*] A satisfactory year! Additions were building at Highland Park which would practically double the capacity of the factory. Yet when the directors met on July 26, Henry Ford proposed that prices be lowered to new levels: the runabout to $345, the touring car to $360, and the chassis (ready for delivery wagon body or other special uses) to $325.[†] They should reach more buyers, he said, and make less money.[1]

"We had, in round numbers," he shortly explained to a reporter, "500,000 buyers of cars on the $440 basis; and I figure on the $360 basis, we can increase the sales to possibly 800,000 cars for the year; less profit on each car, but more cars, more employment of labor; and anyway, we will get all the total profits that we ought to make. And let me say right here, that I do not believe we should make such awful profits on our cars. A reasonable profit is right, but not too much. It

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[*] The Ford Motor Company had changed the dates of its fiscal year. From August 1, 1915, July [illegible] figure for its net profits [illegible] out was cheaper, the close [illegible] hers Suit, 1917, p. 368 ff.

[†] The new prices made in 1916 included, besides those noted, coupé $505; town car $595. *Record, Dodge Suit*, 369. A roar of protest came from the Dodge Brothers, who presently instituted suit to compel the Ford Motor Company to disburse larger dividends.

has been my policy to force the price of the car down as fast as production would permit."[2]

The company had reached maturity. Its policy of a cheaper and cheaper car made in ever-greater numbers at a larger and larger plant had met every test, and seemed certain to achieve new triumphs. Each time the company lowered prices (as it had done every year but two) it tapped a broad new stratum of demand. That the automobile industry was subject to heavy oscillations; that Ford's practical monopoly of the low-priced field might be broken by General Motors or some other manufacturer with large capital resources; that the public might tire of the monotonous Model T design—this was clearly evident. Experts had pointed out that a rich harvest could probably be reaped by a company which sold a better-styled, more comfortable car at just above Model T prices.[3] As yet, however, the House of Ford seemed built on Gibraltar.

Four days after the directors' meeting Henry Ford became fifty-three. He was in his prime, with more than thirty years of life before him. He would have scorned the idea that either he or the company had attained their main goals. That idea was now espoused by the Dodge Brothers, who opposed cheapening the car or doubling the size of the plant; they wanted the company to continue making all the automobiles it could sell at $440, and to distribute the largest possible dividends—for they needed money to build up their own new factory. Ford recalled that when the company began making a hundred cars a day, Malcomson had thought that figure dangerously high.[4] It was part of his philosophy that the only success is continued effort. "Life, as I see it," he later had Samuel Crowther write for him, "is not a location, but a journey."[5] He was then partly immersed in the aftermath of that peace ship venture which inspired such corrosive ridicule. He was developing a farm tractor, on which in 1916 he personally spent about $600,000;[6] he was ready for the construction of a great steel plant; and as that plant would need far more water than Highland Park offered, he was thinking of a vast new factory—of what early in the 1920's became the River Rouge plant, with its tremendous buildings studding nearly two square miles, and its more than 100,000 employees. He had ideas about agriculture and education, too, which he was eager to put into practise.

Experimentation, innovation, and growth were still cardinal prin-

ciples with Henry Ford and his company. Within a few years that company would enjoy an international fame as the greatest single industrial enterprise yet reared on the face of the globe. Yet both the man and the corportion faced dangers of a grave kind. The worst perils had nothing to do with the violent alternations of prosperity and poverty in the automobile industry, with the fact that the Ford Company was measurably the prisoner of its successful design and yet more successful mass production methods which could not be altered except at heavy cost, or with the possibility—soon a reality—of formidable rivals in the low-priced field. They were subtler and more insidious. To examine them we shall have to look into the structure of factory administration, and into the mind and character of the complex genius who was so largely responsible for the company's rule.

2.

The Ford Motor Company in the years 1906–1915 had been an autocracy tempered by the presence on the board of directors of two men, James Couzens and John F. Dodge, who though owners of but minor blocks of stock had a vigor and determination that gave them some real power;* tempered recently, also, by the enlightened vision of young Edsel Ford, whose ideas in plant management and public relations belonged to a wiser generation than his father's. Edsel in 1916 married Eleanor Clay, making his home in East Detroit. Already considerable responsibility had devolved upon his shoulders. The old rule that Couzens was supreme in the business field—marketing, advertising, bookkeeping, finance—as Henry Ford was supreme in production, had still retained considerable validity. Everyone knew that much of the extraordinary success of the company was attributable to the organizing capacity and commercial acumen of this rugged John Bull, so harsh and so charitable, so mean-tempered and so invincibly honest, so hard-hitting and so public-spirited. Down to his

* John R. Lee in his letter to Boyd Fisher, cited above, objected to the use of "despotism," and Fisher agreed that the word was inaccurate, proposing to substitute "autocracy." (*Letter of* June 25.) The board of directors of the Ford Motor Company for many years, since the ousting of Malcomson and death of the elder Gray, had been the same: Ford, Couzens, John F. Dodge, H. H. Rackham, and David Gray. The stockholders were these men, Horace E. Dodge, Rosetta Couzens Hauss, and J. W. Anderson, Henry Ford with 11,700 shares of course had decisive control. On August 18, 1913, John F. Dodge resigned, and on November 20, 1913, F. L. Klingensmith was elected to the board of directors. Couzens remained a director after his resignation of the business managership. Carefully indexed minutes of the directors are kept in the Ford Archives.

resignation in 1915 the public properly gave him almost equal honors with Ford for the company's achievements.* Other men in the period 1906–15, notably Harold Wills, Norval A. Hawkins, and John R. Lee, had an influence which helped limit Ford's autocracy and immensely benefited the company.

It was the opinion of Dr. Marquis, a friend, company executive, and close observer, that from 1914 until 1917 and even later Ford was less interested in details of Highland Park management than previously; that his pacifism, his desire to find a way to shorten the European conflict, along with other special objectives, and his interest in the tractor, distracted his mind from ordinary business.[7] Color is given to this view by the fact that early in 1916 many details of management were entrusted, under the board of directors, to two new committees. An "executive committee" was created—probably on Henry Ford's initiative, though we do not know for what immediate reasons—under Couzens' successor, F. L. Klingensmith, as Chairman, with Edsel Ford [illegible] secretary, and Hawkins and Lee as members. They debated major questions of policy, and reported their recommendations to the directors for final decision. The first meeting was held March 20, 1916, and others followed as often as seemed necessary.[8] In the fall of 1916 this committee, on the suggestion of Klingensmith, drew up a scheme of company organization in three main departments,[9] not for a more logical management of Highland Park administration, which was already satisfactory, but for the efficient handing of correspondence to and from the many branches in America and abroad:

Financial Department	*Sales Department*	*Manufacturing Department*
Banking, Auditing, Law, Real Estate, Charitable Donations	Contracts, Car Servicing, Advertising, General Construction for Dealers and Agents, Outgoing Traffic	Assembling, Plant Construction, Plant Equipment, Purchases, Inbound Traffic

Meanwhile, a larger "operating committee" with Harold Wills [illegible] chairman and John R. Lee as secretary had held the first of its monthly meetings on March 7, 1916. This apparently was Henry Ford's own idea; he had appointed it with the idea that it should investigate and

canvass a broad range of company matters, from the management of branch assembly plants to the provision of better drinking water at Highland Park, and report its findings to the executive committee. At its stated sessions it did cover an extraordinary number of subjects. With a membership of fifteen to eighteen, including three branch sales managers—Plantiff of New York, Block of Philadelphia, and Anderson of St. Louis—it discussed them expertly; and three men, Edsel Ford,[*] John R. Lee, and H. H. Rackham, evinced a gratifying liberalism in matters of labor and public relations.[10]

These two committees, active 1916–17, passed out of existence in 1918. While they lasted they had, as Henry Ford testified in the Dodge suit, enabled the principal executives to "confer on everything that was done."[11] It was a pity the committees did not endure. Their abolition was a token that Henry Ford wished to gather the reins more tightly into his hand.

For the company management, long potentially a despotism, rapidly became just that when John F. Dodge and James Couzens abandoned active participation in the business in 1913 and 1915 respectively.[†] The testimony in the Dodge Brothers' suit to compel larger dividend payments revealed the fact that Ford was making and carrying out many important decisions on policy precisely as if no board of directors existed. During 1915, for example, he laid plans to have Albert Kahn erect a twenty-four-story building at Broadway and 54th Street in New York, the two lower floors to be used for Ford Motor Company showrooms and offices, and the upper stories to be a hotel. Some $560,000 of company money had already been spent on the project when it was first mentioned to the directors at their meeting of November 2, 1916.[12]

So it was with other large undertakings. Important additions to the Highland Park plant, to cost several millions, had been designed, contracted for, and put under construction before the directors ratified

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[*] Dr. Marquis gives a telling instance of Edsel's fine quality. In 1918 a committee was working out plans for distributing a ten million dollar bonus. The shop superintendent suddenly appeared to report that because of the national coal shortage, the plant's electrical power would be cut off next day. It was of no use to plan on distributing ten millions, he added, with an indefinite shutdown facing them. To this Edsel made instant reply: "All the more reason why we should go on with our work, for if there is a prospect of closing down the plant, the men will only need the bonus all the more." As Dr. Marquis says, instances could be multiplied indefinitely of Edsel's ability, courage, justice, and generosity.

[†] Couzens continued for some time to serve as a director, and sat in on policy meetings, but his influence seems not to have been notable.

them at this same October meeting. To promote the company's expansion large realty purchases, one involving a payment of $495,000 in March, 1915, for a Chevrolet Motor Company property, had been executed without board approval. Ford, with the advice of some associates, had decided in the same imperious fashion to build an assembly plant costing $420,000 at Des Moines.[13]

When Ford, cross-examined on this, admitted the irregularity of his actions, the company attorney, Albert Lucking, put in a defensive word. "That is the way they did business always up there, did it when Dodge was on the board, right along. Nobody found any fault, and nobody would now, making so much money they didn't need to."[14] The attorney for the Dodge Brothers, continuing to grill Ford, grew caustic respecting the rubber-stamp board:

> Q. Just give us a single thing that the board of directors have refused to ratify, that you recommended.
>
> A. I don't know of anything.
>
> Q. You don't know of anything?
>
> A. No.

It was another evidence of Ford's growing taste for absolute power that in planning his new tractor plant, he determined to keep entire ownership and control; he frankly said he did not wish to be bothered by the views of minority stockholders.[15] To be sure, he was still capable of taking advice from expert associates. In the summer of 1916, for example, he finally yielded to Couzens, Klingensmith, and Rackham in agreeing to let the Ford Company use part of its surplus, up to ten million dollars, in buying municipal bonds approved by a special committee; he had always opposed such purchases, but his fellow directors convinced him that they were safe, and would pay a larger interest than depository banks.[16] But he sought advice less frequently than of old. Success had given him—and many associates—a feeling that he was almost infallible. Once he issued a certain order. "It's a fool thing, an impossible thing," an executive told Dr. Marquis, "but he has accomplished so many impossible things that I have learned to defer judgment and await the outcome. Take the Ford engine, for example; according to all the laws of mechanics the damned thing ought not to run, but it does."[17]

One-man control, Cæsarism political or industrial, is always dan-

gerous; the precise character of the danger in this instance becomes plain if we examine Henry Ford's character.

3.

That he was a man of highly original mind and personality, quite different from anybody else, and that he was a very complicated man, every intimate agreed. He was full of ideas—the ideas that Samuel Crowther, talking with him at great length, later put into style and pattern in three books signed by Ford, *My Life and Work, Today and Tomorrow*, and *Moving Forward*. Some of the ideas grew out of a vast ignorance; some out of a rich knowledge and experience; but good or bad, they were nearly always his own. He read little. He was not a good conversationalist, and, feeling a certain uneasiness (as General Grant did, for example) in the presence of highly literate men, he got little out of talk with others. But he was that rare person, a man who took time to think. "I have no job here—nothing to do," he said to Faurote, pointing to his clean desk at Highland Park.[18] "If he had something to think about," writes W. J. Cameron, "he would go out in the woods and think for maybe two or three hours. He would get away alone and do his thinking, or ride out in the country for a couple of hours and not say a word."[19]

He was not a copyist; everyone agreed on that. A few of his fundamental convictions were derived from his background. His fierce distrust of Wall Street and belief that Wall Street men were sinister, for example, came partly from the agrarian ferment of the years 1870–96, when he was growing up. As a young fellow he doubtless heard Populistic speeches, and got at second hand the ideas of Altgeld, Bryan, and Edward Bellamy. Later he took the conception of the commodity or energy dollar from Edison. "Once in a while," states W. J. Cameron, "you might get an echo of what someone else had just said to him, but most of what came up was his own. He was a thinker; he wasn't a repeater." Marquis corroborates this. Ford, he writes, left the impression on him that his chief ambition was "to be known as a thinker of an original kind."[20]

It was because he valued thinking so highly that he undervalued books. They "muss up my mind," he said; in short, he had never learned to use them rightly. He was partly correct in saying: "We read to escape thinking. Reading can become a dope habit. . . . Book-

sickness is a modern ailment." He was wholly correct in stating: "A man who cannot think is not an educated man, no matter how many college degrees he has. Thinking is the hardest work that anyone can do." Properly employed, books can guide and enrich thinking, a fact which Ford never grasped. The main point, however, is that he was one of the rare men who are determined to excogitate their own ideas.

He was thinking for himself when he formed the pacifist convictions which permitted him to be drawn into the peace ship adventure. He was thinking for himself when he said that industry is management, and management is leadership, and leadership is perfect when it so simplifies operations that orders are not necessary. He was thinking for himself when he declared that nothing but wide and satisfactory public use could make any private venture permanently profitable. He was thinking for himself when he said that negative attitudes in life are spiritual cowardice: "Fear is the portion of the man who acknowledges his career to be in the keeping of earthly circumstances. Fear is the result of the body assuming ascendency over the soul." His belief that factories ought, so far as possible, to be dispersed over the countryside so that the workers could use their spare hours on the soil was original with him. Original, too, were his ideas on ethics, which emphasized duty; on economics, which emphasized productive work; and on religion, which emphasized a God of duty and of work: "The Lord is working and will clear the land of those who do not go ahead." And he never let his thinking crystallize into fixed form. His associates thought the Crowther books misleading in this respect; the ideas were Ford's all right, but they were frozen in a pattern, while Ford's ideas were "always growing."[21]

He had his own original approach to business. He used to say: "Money is part of the conveyor line." He meant that money, like piles of coal and trainloads of parts, went into making jobs and goods. Or he would say: "Money is just what we use to keep tally." This was not a pose—it was a faith. As a believer in the power of industrial production, he thought he had no right to give money to charity (though he often did). The proper use, he thought, was to reinvest it in production to make more jobs for men and more goods for the general benefit. Thus charity would become unnecessary. As part of this attitude, he looked upon the factory at this period as a semi-public entity. In the Dodge case he kept talking about the Ford Motor Com-

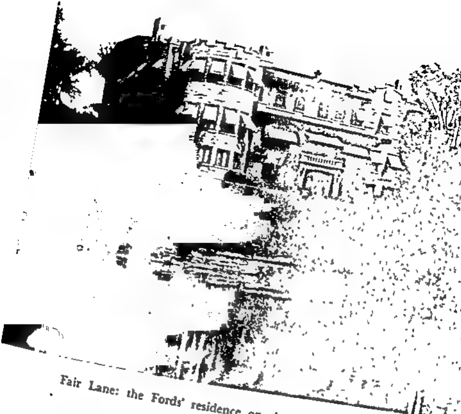
pany as "the institution." Price reduction and plant expansion were for the growth of "the institution." Discussing the investment of surplus funds, he remarked: "I was convinced that it would do more good to the institution to have it in bonds than cash."[22]

This appears to have been an honest attitude. The company was an institution in the sense that it existed not to make money, but jobs and goods, and that it was to continue for generations. He used to tell Edsel: "Well, we'll build this as well as we know how, and if we don't use it, somebody will use it. Anything that is good enough will be *used*."[illegible]

This was the attitude of Thorstein Veblen's master technician, not of a money-maker. He flavored his thinking with an engineer's conscience. "If he could have put a 25-cent gadget on a car that would have made it last a hundred years, he would have put it on." The idea of hoarding money was abhorrent to him. People should use it; should "invest wisely, to begin getting things that make their lives more productive of real values." But he equally condemned spending for mere luxury or pleasure. His own life had been hardworking and in general ascetic. "I have never known what to do with money after my expenses were paid. I can't squander it on myself without hurting myself, and nobody wants to do that." His personal profits were tremendous—but they were nearly all reserved for plant expansion, "to build more and more factories, to give as many people as I can a chance to be prosperous."[24]

The weaknesses of his thinking were four: it was intuitive rather than logical, it too often led him into fields of which he knew nothing, it was more and more tinged with intellectual arrogance or arbitrariness, and it was unsteady and fitful.

"Intuitive" perhaps hardly conveys the full character of his mental processes. He was a man of vision and of visions. In the tax case between the government on one side, Couzens and other minority stockholders on the other, involving a valuation of the Ford Company in 1913, numerous leaders of the automotive industry gave testimony. In nothing did they concur more heartily than in their belief that Ford's "vision" was one of the company's great assets. His first car in 1896, his Model A in 1903, his faith in a standardized cheap car, his development of the Model T, his mass-production methods, were indubitably products of his vision. But the vision had an unsteady



Fair Lane: the Fords' residence on the River Rouge, built 1914–16

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Interior of the Highland Park Plant, showing one of the craneways

The Rouge River near Henry Ford's Fair Lane residence

quality. "He is as temperamental as an artist, and as erratic," writes Marquis.[25] In his own parlance, he had followed his hunches; and because his great primary intuition, that the American people were ready for mass adoption of a new form of transportation, proved completely valid, he came to trust intuitive thinking completely. "Well, I can't prove it, but I can smell it," he said of one of his controversial judgments.[26] This often meant giving too little weight to evidence and logic.

Often his vision was strikingly accurate—particularly when it touched the future of the machine world. Mrs. Ford related that in the early days when automobiles were a great rarity, she and her husband were driving down Fifth Avenue. Henry spoke up. "Do you see this street?" he inquired. It was empty save for a carriage here and there. "There will be two rows of cars going that way, and two rows of cars coming this way." Though she was a Believer, she shook her head incredulously.[27] In such matters his vision was really practical insight. Showing a friend the immense window-space of the plant, he did not make a trite remark on the relations of light, accuracy, and safety. "You know," he said, "when you have lots of light, you can put the machines closer together"—that is, the work could be handled with less lifting. Cameron called him the prime mover of the factory, giving the basic impulse to growth and innovation. One evidence of this was that numerous executives who left the plant continued to speak of him as a sort of master. Even Knudsen is quoted as saying after he had made his striking success in General Motors: "Everything I know, Henry Ford taught me."[28]

He evolved from his intuitive processes of thought certain large conceptions which, more than anything else, account for his spectacular early success. One, of course, was his idea of a car for the masses, built in quantity, and sold at ever-lower prices as consumption grew. Another was his determination to expand his plant, his production, and his sales at a steady pace, in defiance of those who wished to call a halt. He meant to make as many cars as possible at the lowest prices; the ordinary manufacturer worked to restrict production and raise prices. It was another of his basic conceptions, already noted, that he would take ordinary human materials, and from them train skilled workmen and plant executives on the job. After 1907, few men rose to the higher echelons of the Ford Motor Company who had not come up through the ranks.

Sorensen tells a significant story of Easter Monday, 1908. At the Piquette plant a line of costly Potter & Johnson machines stood idle; no skilled mechanics had turned up to operate them. Another line of lathes on which they turned camshafts was half manned. By mid-afternoon these manpower shortages would be holding up the whole factory. As Sorensen discussed the crisis with the foreman, Henry Ford came in. "We are in real trouble, Mr. Ford," said Sorensen, explaining the situation. But Ford was unperturbed. "Well, that is an easy thing to fix," he said. "Easy to fix!" exclaimed Sorensen. "Just how would you fix it?" "Why," said Ford, "go ahead and *make* some skilled men for the jobs." He meant that they were not to go out and buy expert mechanics from other plants; they were to take unskilled men, who were always waiting at the gates, and train them. It was done. "We soon had the machines under way," writes Sorensen. Here was one of Ford's basic conceptions; and into it went his streak of originality, and the faith in common humanity so strong in him at that time.

When he turned to fields in which he lacked skill and experience, however, his intuitions often led him utterly astray; and he was drawn to adventure in such fields as a moth is drawn to an arc-light. His originality of mind, love of sensation, and instinct for advertising frequently impelled him to make rash statements to the press. One such indiscretion, a bit of extreme pacifism, precipitated Couzens's resignation. Particularly did he yield to such impulses after the five-dollar announcement made him a figure of national renown. When he lunched with Woodrow Wilson on July 9, 1914, Washington correspondents made the most of his White House visit and his brash statement as he came out the door: "Cheer up! I agree with the President that the era of prosperity is coming fast!" So rapidly had he risen to the rank of industrial statesman!*

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* Down to the five-dollar announcement, Ford's reputation was restricted to southern Michigan and to industrial circles. From 1910 onward the Detroit newspapers had carried numerous stories on his activities as farmer, bird-fancier, philanthropist, and public-spirited citizen; but the national press had neglected him. Even locally he was no better known than other large automobile manufacturers, like Leland and Olds. Garet Garrett, hurrying to Detroit to report on the five-[illegible] was surpris-
ing how [illegible] Ford legend.
Fame an[illegible] given him
some rep[illegible] to the auto-
mobile w[illegible] denoted to
most Am[illegible] and Colgate
meant so[illegible] "Henry L.

It was his capacity for rash acts, however, which was most alarming. The peace ship venture, the abrupt dropping of Couzens, with his invaluable abilities, and other acts which followed these, disclosed a combination of ignorance, impulsiveness, and bad judgment that would have wrecked a man of less appealing personality, less faith in his own instincts, and less dazzling constructive achievements, past and potential. His motive in the peace ship venture was highly commendable; his method was appalling. When Dr. Marquis expostulated, he resorted to a childish logic. "It is right, is it not, to try to stop war?" "Yes." "Well, you have told me what is right cannot fail."[20] Ford would have been scornful of an artist or writer who meddled with the machine shop at Highland Park. But being an intuitive thinker, with a trust in his own star—or comet—he could not comprehend why men were scornful of his meddling with complex national, international, and racial problems. He could not understand Dr. Marquis's advice that he stick to production problems, labor management, and public relations in the automotive industry.

Much of both his originality and his soundness of instinct in mechanical matters came from the immense amount of time and effort he spent in working, in watching others work under his direction, and in thinking about his work. In building up the company he had labored all the time. "I do not believe a man can ever leave his business," he said. "He ought to think of it by day and dream of it by night." Work he considered the foundation of the world. "Thinking men know that work is the salvation of the race, morally, physically, socially. Work does more than get us our living; it gets us our life." Perhaps no American of the time, not even his friend Edison, was more endlessly on the job and thinking of the job. His intense concentration on engineering, on design, and on manufacturing processes does much to explain why he so far outstripped his competitors. When he moved outside the field of mechanics and production, however, his concentration was slight; he neither thought through nor felt through any political or social question. He discarded the experience of the past

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[illegible] faced as "George Couzens." Ford's [illegible]

99). But from that moment a wave of publicity set in which never [illegible]. As [illegible] writes in *The Hero in America*, everything he thereafter said or did made headlines. His elevation to the stature of a folk hero had not yet come, but it was not far ahead.

—a little later he was to call history bunk. Yet his cocksureness increased. He not merely delivered hasty judgments, but delivered them with absolute finality. Gamaliel Bradford thought that one of his remarks, "The only reason why every man does not know everything . . . is that no one has ever yet found it worth while to know so much," was hard to surpass for intellectual arrogance.[30]

Being impulsive, intuitive, and arbitrary, and letting the rapid success of the Ford Company strengthen these qualities, he not only tended after 1913 to neglect the fields he knew best for adventures beyond the horizon; he was unstable in maintaining some policies to which he had committed himself.

There can be no question, for example, of his whole-hearted enthusiasm for the five-dollar minimum and the work of the sociological department in 1914–15. He was a man of generous impulses. His idealism was as yet a cardinal characteristic. Dr. Marquis, who did not invent conversations, reports at length Ford's defense of the five-dollar plan in 1914. The industrialist argued that five dollars was the lowest daily wage on which a man could decently rear a family; that a business which could pay that wage and refused to do so was bringing up a new generation undernourished in body and under-educated in mind, for which society would have to pay a larger bill in the long run; and that benevolent guidance would generate good will among its recipients:

> "There are thousands of men out there in the shop who are not living [illegible] they should. Their homes are crowded and unsanitary. Wives are going out to work because their husbands are unable to earn enough to support the family. They fill up their homes with roomers and boarders in order to help swell the income. It's all wrong—all wrong. It's especially bad for the children. They are neglected from necessity. Now, these people are not living in this manner as a matter of choice. Give them a decent income and they will live decently—will be glad to do so. . . .
>
> "Blindfold me and lead me down there into the street and let me lay my hands by chance on the most shiftless and worthless fellow in the crowd and I'll bring him in here, give him a job with a wage that offers him some hope for the future, some prospect of living a decent, comfortable, and self-respecting life, and I'll guarantee that I'll make a man out of him."[31]

Here we find Ford speaking with conviction, and there is no doubt that in 1914 and on this subject he had it. John R. Lee in his letter of

June 24 of that year to Boyd Fisher spoke emphatically about Ford's attitude toward the five-dollar day and the plans for its administration. "It is not a fact," he asserted, "that Mr. Ford and others with him feel that the whole system is yet on trial, as stated two or three times in your report." Ford, according to Lee, was aware that the plan was on trial with the public, but had no doubts about it himself.

But conviction which is the result of enthusiasm is one thing and conviction growing out of character and steady purpose another, and in Henry Ford, except for a few beliefs like that in the cheap car, there was a singular lack of consistency and dependability. Close observers wondered if the sociological department—as noble an experiment as American industry had then seen—might not soon lose his support and lie at the mercy of executives who believed that labor should be driven, not led. Men dealing with Ford found no certainties, only an "unlimited uncertainty." In part this was because of the man's kinetic quality; he thought quickly, acted quickly, and was always thinking and acting. In part it was because he believed fixed positions bad for a man or an institution. Change he regarded as the law of a healthy life. In the main, however, it was because of a temperamental mutability, a kaleidoscopic, capricious fitfulness; for he was a mixture of warring elements. Veterans of the Ford Company frequently remarked that he was not one man, but half a dozen, and that they never knew which one they would meet next. He could be all kindliness and helpfulness, or could exhibit his "mean streak;" he could be disarmingly generous or intensely selfish; he could be reasonable or overbearing, modest or flamboyant, sociable or taciturn. The creator of the assembly line never quite assembled himself.*

Dr. Marquis connected the swift transitions between a Dr. Jekyll, all cheeriness, kindness, and idealism, and a Mr. Hyde, full of suspicion, rancor, and restlessness, with physical alternations in the man.

[illegible] Europe, he found—according to some
[illegible] ls and his associates in the experi-
[illegible] version of the Model T. They had
[illegible] ed its general appearance in other
[illegible] ons—the details are lost. Whether
[illegible] ow; neither do we know whether
[illegible] m Ford's fundamental concept of
[illegible] ompany should cling as long as it
[illegible] two employees, it aroused Ford to
[illegible] to the street, and himself helped to
knock it to pieces. (George Brown, *Reminiscences*, [illegible] Archives, corroborated by C. H. Wills, Jr.)

In his better moods Ford was erect, lithe, agile, and full of vitality. In his darker hours his figure stooped, his face was deeply lined, a strange light burned in his eyes, and he looked like an utterly wearied man driven by some inner fury. In his happier frame of mind, which was predominant, he would talk about education for the employees; he would descant on the farmer as the basic element in national life, and the importance of aiding him by providing a more efficient power unit than the horse; or he would extol productive work as a cure for illness, poverty, and social unrest. He was vibrant; his auditors glimpsed a quick, intricate, exciting mind. His sterner periods, if long continued, were usually a harbinger of one of the periodical convulsions in the plant. The storm then had to blow itself out. Other observers, however, presented a more complex analysis than Dr. Marquis. They believed that in Ford's personality were merged the untutored farm boy, the engineer, the industrial manager, the social planner, the entrepreneur, and the hard-driving plant executive; the apostle of rural virtues and the prophet of mass production; the isolationist and the internationalist; the plodder and the seer. They held that all these discordant elements were never properly fused, because his mental processes lacked training, and his character wanted discipline.

"I always said he had a twenty-five track mind," writes W. J. Cameron; and the trains on those tracks often came into collision. Nobody who knew him ever thought him commonplace. "He had a few gadgets in his mind that the rest of us didn't have," states the same observer. "He'd see further and see it faster."[22] But he was incalculable and unstable.

4.

It was another of Ford's disabilities that as the years passed he more and more separated himself from other men. He still went frequently into the shops, chatting with this or that hand as mechanic to mechanic; but it was not with the old sense of comradeship. How could he be comrade to 30,000 employees? After the success of Model T, he spent less time on engineering design, and was therefore less intimate with Harold Wills, Joseph Galamb, and other associates of the engineering room.* He had no vanity. Immersed now in large affairs,

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* To be sure, he controlled advanced engineering work until the day he retired in 1945, taking the most intense interest in new designs; but he had less time for detailed labor.

he never gave the slightest token of feeling any special eminence. When callers at Highland Park reached his presence, they found him unassuming, democratic, and affable. To be sure, he showed a limited conversational faculty, for he disliked small talk and had no fund of anecdote or reminiscence, while it was only with those who possessed his confidence that he let his ideas flow. But he met others as on his own level—if he met them at all.

For inevitably, after he reached fame and fortune, he had to erect barriers around himself. A thousand cranks, a thousand inventors, a thousand social and political theorists, ten thousand promoters, and a hundred thousand beggars great and small, sought his doorstep. At club receptions businessmen clustered about him. When Marquis took him to an ecclesiastical gathering, ministers, bishops, and presidents of denominational colleges formed in line to press their cards—and their requests—upon him. The barriers he constructed became so high that they gave him almost perfect intellectual isolation.[33]

He seldom went to downtown clubs, seldom attended a real discussion, seldom had leaders of large experience and grasp at his house. Highly educated men, as we have said, made him feel uneasy because of their superior fluency in expression. Many of the ablest businessmen of Detroit lived in Grosse Pointe, seat of several Michigan aristocracies: the old landed aristocracy, the later mineral and timber aristocracy, and the newest aristocracy of machines. But Ford did not care for Grosse Pointe. Its artificial social life, a dislike of mere moneymakers, and a feeling that many of its scions were not builders but idle descendants of builders, held him aloof from it. Had he settled there and cultivated the strongest, most congenial men he could find, including other leaders in the automotive field, he would have gained much in information, breadth of outlook, and tolerance.

The problem of a permanent place of residence gave Henry and Clara Ford no little anxiety. They needed ample and well-fenced grounds, for they found by experience that an ordinary house like that on Edison Avenue was hopelessly open to intrusion. Callers came singly or by dozens—to get jobs, to get interviews, to get help on inventions, to get money, or simply to satisfy their curiosity. They would post themselves at the garage at dawn, and invade the porch at the first sign of household life.[34] A guard had to be placed at the front door. The spot the Fords first selected for a refuge was Gaukler

Pointe on Lake St. Clair, where they bought 301 acres with a continuous lake frontage of 3500 feet, and a stream, the Milk River, which Ford wished to deepen and improve. Plans were under way for a house and landscaping when the Fords were alarmed by tokens that they would be expected to become participants in an organized community life. A well-meaning neighbor urged them to attend a meeting of property owners to get acquainted, and they saw they would be members of a social group. Clara thereupon suggested: "If we could build the house we want, I'd like to build out in Dearborn."[35]

The proposal struck Henry Ford as happy. He had begun acquiring land in Dearborn Township, northeast of the original village of Dearbornville, as early as 1908. By the spring of the following year he owned a thousand acres, and in 1911 a reporter credited him with 2150, a holding which at no distant future would be considerably enlarged.[30] At first he wished to use this heavily forested tract, lying along the north branch of the River Rouge, merely as a reserve for birds and wild animals, to which he could escape whenever he wanted a brief taste of country life. One of his first acts had been to turn a number of deer loose in the woods. A little later he obtained the cooperation of the head of the Michigan Audubon Society in a project for using 500 bird-houses and special food to induce many birds—flickers, bluebirds, goldfinches, cardinals, and others—to remain there all winter. When he went to England in 1912 he told Percival Perry of his wildlife preserve; and Perry the following spring sent over almost 500 English birds, including chaffinches, larks, linnets, and thrushes, to be released in the grounds. They quickly scattered over the broad American landscape, where probably few ever survived to bring up a progeny.

Ford had no initial intention of building a home in his unspoiled tract of farm and woodland. It was an area which he had roamed as a boy, and which he like to revisit. A mere bungalow, erected near the river in 1909, sufficed for his purposes. "It was just about where Mr. Ford wanted to be to get away from people who used to chase him all the time," E. G. Liebold later recalled.[31] "It was pretty hard for anyone to find the place." However, Clara's suggestion chimed with his own inclination. They decided to erect their new residence, "Fair Lane," in Dearborn on the banks of the Rouge. Here they would be in the midst of scenes familiar to them as boy and girl, and later as lovers; here they would be within sight of the cottage where they

had made their first home. The house would be larger than a bungalow, but smaller than the pretentious structures that many rich men of Detroit were then erecting; a home with ample room, but a home atmosphere. Ford did not want an army of servants. "I still like boiled potatoes with the skins on," he said, "and I do not want a man standing back of my chair at table laughing up his sleeve at me while I am taking the potatoes' jackets off."[38]

In the summer of 1913 the Detroit *News-Tribune* published a story that Van Holst & Fyfe, Chicago architects, were designing a marble mansion on the Rouge to cost two millions.[39] Ford, confirming that he would establish his home in Dearborn, denied any intention of building lavishly. "What on earth would I do with a palace like that?" he exclaimed. He would erect a modern house of Indiana limestone costing about $100,000, he said, leave Detroit, and make it his home. "We like country life and Dearborn is within easy motoring distance."[40] A pleasant bend of the river, just above the point where he had already erected a dam, was chosen; great forest trees stood all about on three sides, the fourth lying open for a driveway and a vista of fields. Work began that summer on the foundations and a swimming pool, while the power house already built near the dam was redesigned to furnish heating, lighting, refrigerating, water-softening, and dial telephone service for the house, with garage space. Next year Ford, becoming discontented with the original architects, engaged W. H. Van Tine of Pittsburgh, who took over both construction and landscape gardening. The gray walls of Fair Lane rose steadily during 1914–15, to be the home of the Fords for the rest of their lives. House, furnishings, and landscaping and down to Thanksgiving in 1916 cost $1,032,818, while the power plant, the rose garden, and the orchards must have heavily augmented this sum. In the end it probably did cost two millions.[41]

Thus making his home in rural Dearborn, about fifteen miles from the center of Detroit, on an estate large enough for an English nobleman, Ford ensured himself fresh air, quiet, and facilities for outdoor exercise. He could take the long daily walk he liked, or spend an hour observing his beloved birds; he had land for orchards and agricultural experiments. The river became a favorite resort for wild fowl. But the removal had its penalties as well as advantages. Though he had frequent guests—the Edisons, John Burroughs, the Plantiffs, the

Perrys from England, and others—in general the new home deprived him of that reasonably active social life which might have done much to lessen his prejudices, correct his errors, and free his genius from the petty qualities which often clouded it. His mind had never been widened by clashing discussion; his moral qualities had never been given unity and stability. More frequent contact with informed, liberal, and poised men and women might have imparted a certain balance without impairment of his fascinating originality. For it was noticed by friends that he became more withdrawn as the years passed; that he deliberately drew apart. "You know me too well," he said to one intimate, perhaps Harold Wills. "Hereafter I am going to see to it that no man comes to know me so intimately."[42]

One-man control spelt danger for the Ford Motor Company. If it was to be an "institution," as Ford suggested, it should have been measurably institutionalized. The Standard Oil, the United States Steel, most major railroads, had all been institutionalized in the sense that ownership was diffused, and control was exercised not by one man or several, but many. Contrast the elaborate committee structure of the Standard, and the insistence of its numerous strong men—Rockefeller, Flagler, Archbold, Rogers, Warden, Charles Pratt, and others—upon virtual unanimity in any important policy, with Henry Ford's almost autocratic sway. Even after Couzens resigned his business managership, valuable men, to whom the company owed great debts, remained. Harold Wills, so gifted in design, so expert in metallurgy, so well versed in shop method; Norval Hawkins, so able a sales manager and so skillful an organizer of administrative departments; John R. Lee, so happy in labor relations; W. S. Knudsen, so capable in dealing with branch assembly operations—these were still active. Above all, hope could be lodged in Edsel Ford. But their positions, even Edsel's, were precarious. And in the offing, watchful for a chance to gain power, were coarser, harder, more brutal men ready to exploit any opportunity.

Their opportunity would come if the isolated Henry Ford, following what he called his hunches in fields where he had no skill or training, met rebuffs and ridicule which turned his early idealism into cynicism; if for any reason his generous impulses were weakened, and his confusions and contradictions strengthened; if his genial qualities ebbed, and his mean streak broadened.

5.

But thus far the story was both happy and extraordinary. In the dozen years 1903–1915 the Ford Motor Company had written one of the most brilliant chapters of modern industrial history. A few men, starting with a pittance, had in those dozen years built an industrial empire which might reasonably have been capitalized at a half billion; they had done more than all other manufacturers combined to make the automobile a democratic possession; they had been the first to bring mass production, the reshaper of modern life, to birth; they had set a spectacular example in the generous treatment and kindly guidance of unskilled and semi-skilled labor. The spirit in which these accomplishments had been wrought seemed peculiarly American. It was pragmatic, inventive, democratic, often touched with idealism; and already men in America and in numerous other lands were hopefully regarding the attitudes and methods of Highland Park as one promise of a richer era for mankind.

NOTES

APPENDICES

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INDEX

NOTES

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9. Ibid , Chs. XI–XIII; Ch. XXXIII.

10. Quoted in William E. and Ophia D. Smith, *Buckeye Titan*, Columbus, Ohio, 1953.

11. *Journals of Ralph Waldo Emerson. With Annotations.* Edited by Edward Waldo Emerson and Waldo Emerson Forbes. Ten volumes, Boston and New York, 1913, IX, 260–261.

12. Theodore Dreiser, *A Hoosier Holiday*, New York, 1916.

13 Quoted in Slason Thompson, *A Short History of American Railways*, Chicago, 1925, 320–321.

14. See the caustic treatment of American roads in Nathaniel S. Shaler, *The United States of America*. Three volumes, New York, 1894, II, 790–793.

15 Farmers a few miles from Raleigh, North Carolina, had told Frederick Law Olmsted that they grew only enough corn for their own use, for the cost of getting it to market exceeded the price. Olmsted, *A Journey in the Seaboard Slave States*, New York, 1856, 328–330.

CHAPTER II

The Pioneers (*Pages 20–35*)

1. The farm was still in process of being "made." Margaret Ford Ruddiman, William Ford's daughter, recalled in an interview held on April 29, 1952, that ten years after Henry Ford's birth [illegible] timber was being cut on the land. [illegible] ford, and far [illegible] tor Com-

pany's Engineering Section in the 1930's. An entry reads: "Infant son of William and Mary Ford, died Jan. 29, 1862." Accession 23, Box 28, Ford Archives.

4. So Margaret Ford Ruddiman described her father in 1951. See her *Reminiscences*, Ford Archives, based on tape-recorded interviews. Mrs. Ruddiman also wrote an account of her family and her brother, and this will be referred to as "Written Memoir."

5. Wages and prices are taken from the files of the Detroit *Free Press* and *Advertiser and Tribune* for the year 1863. Marvin Buckberry, a Ford employee who collected materials for a biography of Henry Ford, was told by George Holmes, son of Mrs. Holmes, that the birth was at 7 A.M., and that his mother was paid $5. Accession 42, Box 1, Ford Archives.

6. The various Michigan units that saw service in the Civil War and their role at Gettysburg are noted in John Robertson, *Michigan in the War*, Lansing, 1882. The part of Wayne County units in that battle is covered on pp. 186, 242, 275–276, 365, 440–444, and 536.

7. Henry A. Haigh, "The Old United States Arsenal at Dearbornville," *Michigan History Magazine*, XXVIII, Oct.-Dec., 1944. "The place was turned into a training ground for new recruits, and usually a full regiment of infantry and a battery of artillery was drilling there before leaving for the front."

8. Accession 23, Box 28, Ford Archives. Dr. Webster says that the name derived from the Irish words "magh," a plain, and "damh," an ox. Webster was at various times Rector of Blackrock, Cork, Canon of St. Patrick's cathedral, Dublin (Anglican), and Dean of Ross. He was familiar with the country in which the Fords lived. He discovered an unexecuted lease dated 1819, and made out to Rebecca Ford, John's mother, and to John, then 20; also one taken by John himself in 1843. These are described in a memorandum he wrote for the Ford Motor Company. The first lease would seem to show that John's father, William, had died about 1818.

9. The city of Cork lies only about 25 miles northeast of Clonakilty; Queenstown (now Cobh) is about 30 miles away.

10. See genealogical papers, Ford Archives, Accession 23, Boxes 27, 28, and 31.

11. Accession 23, Box 28, Ford Archives. Memoranda of Campsall and Laird indicate clearly their acceptance of the Webster account.

12. Lord Perry is quoted from a tape-recorded interview with the author on March 28, 1952, at Nassau. Later in England he added further details which are incorporated here.

13. Webster, "Notes," cited in 11, above.

14. Arthur H. Hensinlsveld of Iowa City (University of Iowa) to Henry Ford, Jan. 29, 1926. Accession 23, Box 28, Ford Archives.

15. Accession 23, Box 27, Ford Archives. Data on Rebecca's sons are furnished by various genealogical sheets filled out by their descendants.

16. Clyde Ford, *Reminiscences* (typescript), 1. Ford Archives. The manuscript is unsigned, but internal evidence clearly proves the authorship. Clyde Ford was the great-grandson of Samuel, through the latter's son George and his son Addison Ford.

17. *Ibid.*; also Mrs. Ruddiman's *Reminiscences*.

18. Oliver W. Holmes, Chief Archivist, National Resources Records Branch, to Henry Edmunds, Archivist, Ford Archives, May 27, 1952. Samuel bought the east ½ of the N.E. ¼, Sec. 1, Township 2 South, Range 10 E., which is the extreme northeastern corner of Dearborn Township; George bought the west ½ of the S.W. ¼ of Sec. 6, Township 2 S, Range 11 E., the extreme southwestern tip of Greenfield Township. George's marriage is recorded in several genealogical sheets, Accession 23, Box 27, which presumably are filled out from Bibles and family books of record.

19. William Nowlin, *The Bark Covered House or Back to the Woods Again*, Detroit, printed for the author, 1876. The ensuing account of the Nowlins is taken from this simple but exciting chronicle.

20. Accounts of the Dearborn arsenal are numerous. See note 7 above; Floyd L. Haight, "Some Early Dearborn History," *Michigan History*, XXXII, Mar., 1948, 84–87; Henry Haigh, "Early Days in Dearborn," *Michigan History*, V, July-Oct., 1921, 536–560; Detroit *Daily Post*, April 25, 1870; John T. Blois, *Gazetteer of the State of Michigan*, Detroit and New York, 1839 The arsenal grounds covered several hundred acres and contained eleven buildings; in the village

by 1839 there were seven stores, and the Nowlins apparently got their provisions in Dearborn from the time they arrived there.

21. Clyde Ford, *Reminiscences*, 3.

22. James H. Lanman, *History of Michigan*, New York, 1839, 229.

23. Clyde Ford, *op. cit.*, 5.

24. Nowlin, *op. cit.*, 75. The punkwood was found in the center of old maples where there were black knots near the top. It was dried and was easy to light with a spark

25. Clyde Ford, *op. cit.*, 5–6.

26. *Ibid.*, 22.

27. Nowlin, *op. cit.*, pp. 58

[illegible]

tion 23, Box 27.

30. Accession 23, Box 28, Ford Archives.

31. Mrs Sophia B. Moyles of 4106 South L, Tacoma, Washington, supplied data on Robert Ford [illegible] Hornbrook in 1827, and Mrs. [illegible] The last-named, Mrs. [illegible] However, since the [illegible] that any of Robert's progeny *remained* in Ireland. Accession 23, Box 27, Ford Archives.

32. Margaret Ford Ruddiman, Written Memoir, I, 1.

33. Folder, "Ford Family," Burton Historical Collection, Detroit Public Library. One item, "The Henry Ford Family," contains Dr. Quaife's interview with Mrs. MacDonald. A second, "Genealogical Data on the Ford Family: Some Ancestors and Descendants of Henry Ford, of Dearborn, Michigan," compiled by Mrs. Elleine H. Stones, Chief of the Burton Historical Collection, is based on Mrs MacDonald's recollections and other sources.

34. Leon Roy, Archivist, D.P.C.S., Quebec, Canada, to Henry Edmunds, Archivist, Ford Archives, March 27, 1952.

35. Clyde Ford, *op. cit.*, 3.

36. Frank Leslie Stevenson, "Scotch Settlement," MS., Burton Historical Collection, Detroit Public Library.

37. Abstract Book for Section 35, Redford Township, Wayne County, Michigan. This shows that Henry Maybury sold John Ford the W. ½ of the S.W. ¼ of Section 35, Township 1 S., Range 10 E. In 1876 Maybury owned 80 acres adjoining John Ford's (then Henry Ford's—son of Samuel Ford, John's brother) farm to the west, and 80 acres in Springwells Township touching the original Samuel Ford farm to the east.

38. Margaret Ford Ruddiman, Written Memoir, II, 17.

CHAPTER III

The Childhood of an Industrialist (*Pages 36–53*)

1. James H. Lanman, *History of Michigan*, 233.

2. Clarence M. Burton and M. Agnes Burton, *History of Wayne County and the City of Detroit, Michigan*, Chicago and Detroit, 1930, I, *passim;* Silas Farmer, *History of Detroit and Michigan*, Detroit, 1884.

3. E. D. Kennedy, *The Automobile Industry*, New York, 1941; Ralph C. Epstein, *The Automob*[illegible] New York, 1928.

4. [illegible] *ollections*, XXII,

5. [illegible] 1893, 305–404.

6. A. S. Hill, "The Romance of a Railway," *Michigan History*, XXIII, winter, 1939, 53–75.

7. Clyde Ford, *Reminiscences*, 21–22; also William Nowlin, *The Bark Covered House*, 136,

148–149. According to Nowlin, the sale of cordwood in the late 1830's brought a poor return; by 1848 it was doubtless a better source of income.

8. Nowlin, *op. cit.*, 150–151.

9. *Michigan Farmer*, VI, Jan. 1, 1848, 15. Paragraph, "Central Railroad."

10. Margaret Ford Ruddiman, Written Memoir, I, 1.

11. *Ibid.*, III, 2. Patrick enlisted in the British Army and deserted in Canada, states Ann Hood's MS. account of Henry Ford's childhood, in the Ford Archives.

12. Marg [illegible] written me [illegible] pendix II. [illegible] tions, and [illegible]

13. Fran [illegible] Ford writes in his *Reminiscences*: "The Ford Settlement was the beneficiary for having such a community on the south side of them."

14. Abstract Book for Section 35, Redford Township, Wayne County Court House, Detroit. Possibly William Ford owned a tract or two in other townships, but this seems unlikely.

15. The certificate and other papers are in Accession 42, Box 1, Ford Archives.

16. Interview with Margaret Ford Ruddiman, April 29, 1952.

17. The house, fully restored, now stands in Greenfield Village.

18. These transactions are recorded in Abstract Books of Sections 12 and 13, Dearborn Township, and Abstract Books of Sections 7 and 18, Springwells Township, Wayne County Court House, Detroit. For the sale of William's forty acres at $2500, see Abstract Book of Section 35, Redford Township.

19. A picture of the Ford farm in the 1876 Atlas of Wayne County shows thirteen cattle, a team of horses, a horse being watered, and chickens. Mrs. Ruddiman in her *Reminiscences* speaks of a small flock of sheep.

20. Henry A. Haigh, "Later Days in Dearborn," *Michigan History*, VIII, July, 1924, 273–297, written by a man nine years older than Henry Ford and reared on a farm near Dearborn, furnishes a good account of a rural life at the time.

21. MS. statement by Henry Ford, undated, in Box 1, Selected Documents, Ford Archives. This account was written by Ford in one of his "diaries": little blank books, most of them two by three inches, though this one is larger. The diaries contain scattered jottings, this notation being one of the longest.

22. So says Margaret Ford Ruddiman, Written Memoir, III, 4–5.

23. Selected Documents, Box 1, Ford Archives.

24. Family record book, photostat, Accession 23, Box 28, Ford Archives.

25. Margaret, born in 1867, recalled seeing the candle molds, but remembered lamps as being used exclusively in her girlhood.

26. These "diaries" or memorandum books contain a considerable number of jottings which he made to aid a high school girl who was writing a paper upon his life. Carefully preserved in the Ford Archives, they really throw more light upon his career than is evident from a hasty reading.

27. The autobiography of U. P. Hedrick, *The Land of the Crooked Tree*, New York, 1948, offers what may well become a classic record of farm life in Michigan; he was a contemporary of Ford, reared in a wilder district.

28. Stevenson, *op. cit.*, and Clyde Ford, *op. cit.*, 4–6.

29. Fair Lane Papers (Accession 1), Boxes 112–117, Ford Archives. (Hereafter cited as "Fair Lane Papers.") As in this case, many of the entries in such "diaries" were single, unrelated sentences, or even phrases. As to the age for beginning school, Edsel Ruddiman was barely six years old when he commenced to go—on the same day that Henry Ford did.

30. Margaret Ford Ruddiman, Written Memoir, II, 1.

31. *Ibid.* Mrs. Ruddiman mentions a blackboard, but does not describe it.

32. Margaret Ford Ruddiman, *Reminiscences*.

33. There is some doubt about the teacher. Edsel Ruddiman suggested rather tentatively that Frank Ward was in charge; Mrs. Ruddiman in her *Reminiscences* named Miss Nardin, and

W. A. Simonds, soon to be cited, and others have agreed. However, in an interview with Miss Nardin in the 1920's, Simonds reported that she stated 1854 as the year of her birth, and named 1873 as the year she taught the Scotch Settlement School. She might have been mistaken about the date of teaching or of her birth, or both. I have assumed that Mrs Ruddiman and Simonds [illegible]

William A. Simonds, *Henry Ford, His*

27. Hereafter cited [illegible] "Simonds, *Henry*

14-page unsigned interview with Ford which seems [illegible] have been carefully and intelligently done; Fair Lane Papers, Box 118. It referred to the Miller, not the Scotch Settlement School.

35. Letter of January 24, 1886; Box 1, Selected Documents, Ford Archives.

36. Simonds, *op. cit.*, 27.

37. McGuffey was professor of languages at Miami University, Ohio, then president of Cincinnati College and of Ohio University at Athens. He taught for many years at Woodward College, Cincinnati, and at the University of Virginia.

38. McGuffey's work is discussed in Harvey C. Minnich, *William Holmes McGuffey and His Readers*, New York—Cincinnati, 1936, and in Richard Mosier, *Making the American Mind: Social and Moral Ideas in the McGuffey Readers*, New York, 1947, while Ford himself helped to select *Old Favorites from the McGuffey Readers*, New York—Cincinnati, 1936, and reprinted a full set of readers, 1857 edition.

39. William A. Simonds, *Henry Ford and Greenfield Village*, New York, 1938, 8.

40. William C. Richards, *The Last Billionaire*, New York, 1950, 165.

41. Margaret Ford Ruddiman, *Reminiscences.*

42. *Ibid.*

43. *Ibid.*

44. *Ibid.*

45 [illegible] Miller said to Donald M. Currie, who interviewed a number of Henry Ford's schoolmates in April, 1943. See "Henry Ford—Education," Fair Lane Papers.

46. Simonds, *Henry Ford*, 30.

47. Margaret Ford Ruddiman, *Reminiscences.*

48. Henry Ford in collaboration with Samuel Crowther, *My Life and Work*, Garden City, 1923, 22, 24, and 200. This book will be referred [illegible] as *My Life and Work* hereafter. While the writing was undoubtedly Crowther's, the ideas in this instance are unquestionably Ford's.

49. Edgar A. Guest, "Henry Ford Talks About His Mother," *American Magazine*, July, 1923, 11–15, 116–120.

50. Allan L. Benson, *The New Henry Ford*, New York, 1923, 20. The cake-and-sandwich story appears in several variations, the one used here being chiefly that given in two different unsigned versions in the Ford Archives.

51. W. J. Cameron, *Reminiscences*, Ford Archives.

52. Clyde Ford, *op. cit.*, 22.

53. The date of March 17 is taken from R. H. Laird's notes on the Ford Cemetery headstones and is that of the death of the child. It is twelve days earlier than Mary Ford's.

54. Simonds, *Henry Ford*, 34.

55. A rhymed version of this sentiment appears on the stone of Dorah Ford, a near relative, reading:

> Dearest, thou has left us
> Here, thy loss we deeply feel
> But 'tis God that hath bereft us
> He can all our sorrows heal.
>
> Yet again we hope [illegible] meet thee
> When the day of life [illegible] fled
> Then in heaven with joy to greet thee
> Where no farewell tears is shed.

56. Margaret Ford Ruddiman, Written Memoir, III, 3.

57. In Fair Lane Papers, Box 173, Real Property, William Ford, Ford Archives, appears a notice dated Aug. 14, 1901, addressed to Wm. Ford, Jr., with respect to running a road through his property.

58. Margaret Ford Ruddiman, Interview of April 29, 1952. Mrs. Ruddiman seems to say

that the house was moved before the cellar was built, and that the cellar was dug some time after its removal.

CHAPTER IV

Youth and the Machines (*Pages 54–73*)

1. *My Life and Work*, 22.

2. U. S. Circuit Court, Southern District of New York: Electric Vehicle Company and George B. Selden *vs.* C. A. Duerr & Co. and the Ford Motor Company, *et al*, IX, 30–32, 54. Hereafter cited as "Selden Case Record."

Of the five suits comprised in the Selden Patent Case (1903–1911), three were known as Ford suits and two as Panhard. (See text of Chapter XIII for details.) The five were essentially one as to the issues involved and the decision rendered. The total record included testimony and exhibits for the complainants and defendants, briefs, transcripts of oral hearings, and the judges' decisions, circuit and appellate. There has never been any authorized collection of all this material as a single unit. However, under direction of the clerk of the appellate court the testimony and exhibits for the complainants and defendants, with some additional material, were arranged in twenty-one volumes. These did not include briefs or transcripts of oral hearings. In this volume, citation is made to this court record by volume and page for testimony and exhibits. Briefs are designated by authorship and as "circuit" or "appellate." For oral arguments the same designation ("circuit" or "appellate") is used. The judges' opinions, printed in *The Federal Reporter*, are cited by volume and page of that publication.

3. *Ibid.*, 55.

4. Fair Lane Papers, Box 114, Notes and Diaries, Ford Archives.

5. The Royal Society, *Newton Tercentenary Celebrations*, Cambridge, 1947, 83.

6. H. L. Barber, *Story of the Automobile*, Chicago, 1917. According to Barber, the machine was rescued from the junk heap and installed in the Paris Conservatory, where apparently he saw it.

7. Arthur Pound, *The Turning Wheel*, Garden City, 1934, 10–11.

8. W. Worby Beaumont, "Mechanical Road Carriages," *Scientific American Supplement*, XLI, Mar. 7, 1896, 16828.

9. Pound, *op. cit.*, 18.

10. *My Life and Work*, 22–24.

11. Accession 1, Boxes 112–117, Notes and Diaries, Ford Archives.

12. Simonds, *Henry Ford*, 28; also Benson, *The New Henry Ford*, 28–31.

13. Simonds, *op cit.*, 28.

14. Margaret Ford Ruddiman, *Reminiscences*.

15. Two of a number of volumes which were written on the Exposition, and have been used as sources of information here, are James D. McCabe, *The Illustrated History of the Centennial Exhibition*, Philadelphia and other cities, 1876, and J. S. Ingram, *The Centennial Exposition*, Philadelphia and other cities, 1876, both of which rehearse its inception, financing, and preparations, and provide detailed descriptions, with many engravings, of the exhibits.

16. There are three George Fords who might conceivably have been William Ford's companion: George, son of John's brother George, then 31; George, the son of Samuel, who was 45; and George, son of Henry Ford, also Samuel's son, who had married William's sister Mary. He was only 19, but presumably lived on Joy Road, and to a girl of nine might well have seemed to be in his twenties.

17. "Gas Engines," signed J. T. H., *Scientific American Supplement*, I, May 27, 1876, 339.

18. Abbé Hautefeuille of Orleans, France, in 1678 outlined the first known gunpowder engine, which was never built. Christian Huygens, a Dutch physicist and astronomer living in Paris, designed an engine with a piston and cylinder and built an unsuccessful model. His assistant Denys Papin 1690 improved this model, but also was unsuccessful. However, his experiments led directly to the first piston steam engine. See Robert H. Thurston, *A History*

of the Growth of the Steam-Engine, Ithaca, N. Y., 1939, 25–26; Rolla C. Carpenter and H. Diederichs, *Internal Combustion Engines*, 3rd ed., New York, 1910, 232–233.

19. Bryan Donkin, *A Text-Book on Gas, Oil and Air Engines*, 5th ed., London, 1911, 21. Donkin also covers experiments with gunpowder, pp. 19–20.

20. *Ibid.*, 21.

21. *Journal of the Franklin Institute*, V, Jan. 11, 1828, 18–20. Dugald Clerk, "The Gas Engine," *Scientific American Supplement*, XIX, April 11, 1885, 7720–7721. Donkin, *op. cit.*, 22.

22. Carl W. Mitman, "Samuel Morey," in *Dictionary of American Biography*, XIII, 161–162, also Morey's own statement, "An Account of a New Explosive Engine, Generating a Power That May Be Substituted for That of the Steam Engine," *American Journal of Science and Arts*, XI, 1826, 104–110.

23. *Scientific American*, XI, Dec. 8, 1855, 99.

24. Joseph Wickham Roe, *English and American Tool Builders*, New Haven, 1916. Roe describes Watt's effort in 1765 to bore a cylinder; he could not get satisfactory machining until 1776 (2–3). This admirable book covers in detail the early lack of dependable machine tools, the non-existence of standardization, interchangeability of parts, and so forth

25. Donkin, *op. cit.*, 27–28; also in *Polytechnic Review*, New York, VI, Sept. 14, 1878, 151–153, there is a description of the use of the free piston as applied to the Otto & Langen motor. This explains the device and applies partially to the Barsanti and Matteucci engine, which was earlier in the field. On p. 48 of Paul Siebertz's *Gottlieb Daimler* (see Note 29 below), diagrams of the Barsanti and Matteucci engine show the free and working pistons and the device for turning the shaft.

26. It worked out to about 10¢ per horsepower hour, while a small steam engine cost 6¢. But the extra labor and space required for the latter offset its lower cost.

27. "Lenoir's Gas Engine," in section "Monthly Notes," *Mechanic's Journal*, IX, 2nd series, 1864, 248–249. For a general account of Lenoir's motor, see Donkin, *op. cit.*, 29–34.

28. Donkin, *op. cit.*, 29–34; also Dugald Clerk, *The Gas, Petrol, and Oil Engine*, 2 vols., London and New York, [illegible] Carpenter and Diederichs, *op. cit.*, 229–242. The [illegible]

29. Paul Siebertz, *Gottlieb Daimler: Ein Revolutionar der Technik*, München-Berlin, 1941, [illegible]

30. [illegible] two-cylinder [illegible] and an engine [illegible]

31. Siebertz, *op. cit.*, 46, 51–52.

32. "The Langen & Otto Gas Motor," *Polytechnic Review*, Philadelphia, I, May, 1876, 50.

33. Siebertz, *op. cit.*, 59. "Gas Engines," *Polytechnic Review*, New York, VI, Sept. 14, 1878, 152.

34. *Scientific American Supplement*, I, May 27, 1876, 339. This statement may have had a basis, but later opinion pronounced the Brayton much more wasteful of fuel.

35. Simonds, *op. cit.*, 29; and Sarah T. Bushnell, *The Truth about Henry Ford*, Chicago, 1922. Simonds states that one of his teachers remarked: "Henry, you seem to use the geography more than any other book." Henry grinned, and so did the other pupils. Mrs. Bushnell pictures Addison Brush as discovering what was going on when the geography fell with a bang, and disciplining Henry and his brother John, who was also "tinkering."

36. Margaret Ford Ruddiman, *Reminiscences*.

37. Edsel Ruddiman, *Reminiscences*, 3–4.

38. Margaret Ford Ruddiman, *Reminiscences*.

39. Margaret Ford Ruddiman, Interview of Nov. 5, 1951, 15.

40. Simonds, *op. cit.*, 27

41. Margaret Ford Ruddiman, *Reminiscences*, and interview of April 29, 1952.

42. Simonds, *op. cit.*, 30–31; Accession 1, Boxes 112–117, Notes and Diaries, Ford Archives. Ford's note in his diary, undated, reads: "Sawmill at Dearborn. Cylinder Tipped over and

caught my Arm dug for ½ hour to get out. . . . It was a Fulton Engine Made in Detroit Mich I was about 15 ys old." Further details are from Simonds.

43. Margaret Ford Ruddiman, *Reminiscences.*

44. *Ibid., My Life and Work*, 24.

45. Edgar A. Guest, "Henry Ford Talks about His Mother," *American Magazine*, July, 1923, 120.

46. Margaret Ford Ruddiman, Written Memoir, IV, 3.

47. See J. W. Leonard, *Industries of Detroit*, Detroit, 1887, 95–100; also Silas Farmer, *History of Detroit and Wayne County and Early Michigan*, Detroit, 1890, 805. The works in the 1880's employed from 1900 to 2500 men and covered from 30 to 40 acres of land.

CHAPTER V

A Persistent Apprentice (*Pages 74–91*)

1. Silas Farmer, *History of Detroit and Michigan*, 804. The location is given as Grand Trunk Junction, which in 1879 was in Springwells Township, but was soon to be brought within the city limits.

2. Clarence M. Burton and M. Agnes Burton, *History of Wayne County and the City of Detroit, Michigan*, I, 340–341. Also Farmer, *op. cit.*, 336, for population totals and character. Many of the foreign born were English, Irish, Scottish, and from "British America,"—more than 23,000 all told. There were 1771 Poles.

3. *Compendium of the Tenth Census* (June 1, 1880), Washington, Government Printing Office, 1883. Two Parts. I, 390. Industries are listed on pp. 1058–1059, Iron and Steel leading with $2,498,634 product-value, Foundry and Machine Shop second with $1,808,355, and Shipbuilding third with $738,975. Also Farmer, *op. cit.*, 893–906; J. C. Ferry, compiler, "Detroit Manufacturing Industries—History of Detroit Factories in 1891," a leaflet, and other sources. Farmer does not mention the Flower firm, but concedes that his list is not complete.

4. Farmer, *op. cit.*, 893–906. Farmer gives a fairly full and apparently accurate account of most of the roads.

5. Robert E. Roberts, *Sketches of the City of Detroit*, Detroit, 1855, 10, 12. The pear trees had been brought from France in the eighteenth century, and were regarded by Detroiters with sentimental pride. They were celebrated by at least one local poet, whom Roberts quotes. In 1883 Farmer said they had "largely disappeared."

6. Farmer, *op. cit.*, 28–29. Woodward's memorandum book for 1802 contained a map of the City of Washington cut into sections, says Farmer. Woodward Avenue was, of course, named for the judge, although he was fond of saying that it was so named because its course north was toward the woods—"woodward."

7. *Ibid.*, 34, shows the plan essentially as it was; for parks, see 73–79. *Belle Isle was purchased* by permission of the state, and was already partially developed, with two avenues *running* from end to end, and a road around the shore. In 1882 there were 268,000 visitors, indicating that Detroiters appreciated the acquisition. Henry Ford may have been among those who came, but [illegible] 885, and his [illegible] *cit.*, shows [illegible] rounds, and the fences. Roberts, *op. cit.*, 150, gives the miles of paved streets.

9. Roberts, *op. cit.*, 151

10. George W. Stark, *City of Destiny: the Story of Detroit*, Detroit, 1943, 396. The first telephone directory was printed in Nov., 1878, by the Telephone and Telegraph Construction Co., with its 124 customers. Only 83 of these could reach each other. Many telephones were between the office of an employer and his home.

11. Robert E. Roberts, *Sketches and Reminiscences of the City of the Straits*, Detroit, 1884, 151.

12. *Ibid.*, 116. Roberts also gives the statistics quoted here on the police and fire departments, and the street railways. See Farmer, *op. cit.*, 207, for police.

13. Margaret Ford Ruddiman, Written Memoir, IV, 3. Mrs. Ruddiman says that William found Henry at the Flowers' shop. If he waited a week, this would be true. Henry's boarding place was rather near Grand Junction, which suggests that he chose it while still there, hence after a night or two with the Flahertys, who lived at a great distance from the Michigan Car Company.

14 See map of Springwells, *1876 Atlas* Four roads seem to have met at the Junction. The plant and properties of the Car Company are clearly indicated

15. "Freight Cars," a clipping in the C. L Walker Scrapbook, Vol. 5, 62–64, Burton Historical Collection, Detroit Public Library. The clipping is undated, but internal evidence indicates that the account was written and published in 1877.

16. Farmer, *op. cit.*, 804. J. W. Leonard, *The Industries of Detroit*, 99–100, gives the figure of 10,000 cars in 1887.

17. W. J. Cameron, *Reminiscences.*

18. W. A. Simonds, *Henry Ford*, 35.

19. Fair Lane Papers, Box 114, Notes and Diaries.

20. Margaret Ford Ruddiman, Written Memoir, IV.

21. J. W. Leonard, *op. cit.*, 217. He lists them as "makers of stop-valves and fire hydrants."

22. *My Life and Work*, 24; Mrs. Ruddiman mentions the apprenticeship both in her Written Memoir and in her recorded interviews held to supplement this account.

23. The Detroit *Journal* of July 1, 1895, records the death of George Flower and states that James had died nine years earlier—1886. The Detroit *Evening News* of Sept 30, 1901, carries an item on Thomas's death. He had retired in 1890.

24. Detroit *News*, Sept. 5, 1921: "Detroit Loses Genius' Cradle"

25. Simonds, *op. cit.*, 35–37. This is by far the most detailed account of Henry Ford's work at McGill's, but he himself speaks of working for a jeweler during this period, and his sister and Marvin Buckberry confirm the fact, the latter giving McGill's address. They spell the name "McGill," Simonds "Magill."

26. Accession 42, Box 1, Buckberry Notes, p. 7 of written MS. Ford Archives.

27. Various associates heard this oft-repeated statement.

28. *My Life and Work*, 30, 45–46.

29. *Official Gazette of the United States Patent Office*, XII, Washington, 1878, 277–278. The patent was No. 94,047, and was issued Aug 14, 1877. The New England Cotton Manufacturers' Association, *Proceedings of the Seventeenth Annual Meeting*, Boston, 1882, 46, notes the sale of the engines in 1882.

30 *My Life and Work*, 27.

31. *Ibid.*, 28.

32. Simonds, *op. cit.*, 37.

33. Fair Lane Papers, Box 118, envelope, Interviews. The statement is given on p. 11 of a 14-page interview, unsigned, previously cited. The four-year period mentioned here is elsewhere spoken of by Ford as a three-year period: *My Life and Work*, 24; and actually he seems to have served less than that.

34 Simonds, *op. cit.*, 37.

35. Farmer, *op. cit*, [illegible], gives a brief history of the company and pictures of its two plants—the fullest of ac [illegible] C. Campbell of Campbell, Owen & C [illegible] tendent at Wyandotte. [illegible] the *Boston*, 1880, 1829 tons.

36. *Detroit Journal*, 13th Anniversary Edition, Aug., 1895.

37. Elleine H. Stones, "Frank E. Kirby," *Inland Seas*, VII, winter, 1951, 78.

38. Fair Lane Papers, Box 118, Ford Archives: Interviews. This is a two-and-a-half-page interview, unsigned, and marked "Henry Ford Ad."

39. *My Life and Work*, 24.

40. *Ibid.*, 24.

41. Simonds, *op. cit.*, 38.

42. See Accession 42, Box 1, Ford Archives, p. 7 of Buckberry's brief written account of

caught my Arm dug for ½ hour to get out. . . . It was a Fulton Engine Made in Detroit Mich I was about 15 ys old." Further details are from Simonds.

43. Margaret Ford Ruddiman, *Reminiscences.*

44. *Ibid.; My Life and Work*, 24.

45. Edgar A. Guest, "Henry Ford Talks about His Mother," *American Magazine*, July, 1923, 120.

46. Margaret Ford Ruddiman, Written Memoir, IV, 3.

47. See J. W. Leonard, *Industries of Detroit*, Detroit, 1887, 95–100; also Silas Farmer, *History of Detroit and Wayne County and Early Michigan*, Detroit, 1890, 805. The works in the 1880's employed from 1900 to 2500 men and covered from 30 to 40 acres of land.

CHAPTER V

A Persistent Apprentice (*Pages 74-91*)

1. Silas Farmer, *History of Detroit and Michigan*, 804. The location is given as Grand Trunk Junction, which in 1879 was in Springwells Township, but was soon to be brought within the city limits.

2 Clarence M. Burton and M. Agnes Burton, *History of Wayne County and the City of Detroit, Michigan*, I, 340–341. Also Farmer, *op. cit.*, 336, for population totals and character. Many of the foreign born were English, Irish, Scottish, and from "British America,"—more than 23,000 all told. There were 1771 Poles.

3. *Compendium of the Tenth Census* (June 1, 1880), Washington, Government Printing Office, 1883. Two Parts I, 390. Industries are listed on pp. 1058–1059, Iron and Steel leading with $2,498,634 product-value, Foundry and Machine Shop second with $1,808,355, and Shipbuilding third with $738,975. Also Farmer, *op cit.*, 893–906; J. C. Ferry, compiler, "Detroit Manufacturing Industries—History of Detroit Factories in 1891," a leaflet, and other sources. Farmer does not mention the Flower firm, but concedes that his list is not complete.

4. Farmer, *op. cit*, 893–906. Farmer gives a fairly full and apparently accurate account of most of the roads.

5. Robert E. Roberts, *Sketches of the City of Detroit*, Detroit, 1855, 10, 12. The pear trees had been brought from France in the eighteenth century, and were regarded by Detroiters with sentimental pride. They were celebrated by at least one local poet, whom Roberts quotes. In 1883 Farmer said they had "largely disappeared."

6. Farmer, *op. cit.*, 28–29. Woodward's memorandum book for 1802 contained a map of the City of Washington cut into sections, says Farmer. Woodward Avenue was, of course, named for the judge, although he was fond of saying that it was so named because its course north was toward the woods—"woodward."

7. *Ibid.*, 34, shows the plan essentially as it was; for parks, see 73–79. Belle Isle was purchased by permission of the state, and was already partially developed, with two avenues running from end to end, and a road around the shore. In 1882 there were 268,000 visitors, indicating that Detroiters appreciated the acquisition. Henry Ford may have been among those who came, but there is no evidence to this effect. He was a frequent visitor in later years.

8. J. Bell Moran, *The Moran Family*, Detroit, 1949, 88–91. Moran was born in 1885, and his recollections are of the '90's, but probably apply to the city in 1880. Farmer, *op. cit.*, shows dozens of the outstanding residences and gives a good idea of the architecture, the grounds, and the fences. Roberts, *op. cit.*, 150, gives the miles of paved streets.

9. Roberts, *op. cit.*, 151.

10. George W. Stark, *City of Destiny: the Story of Detroit*, Detroit, 1943, 396. The first telephone directory was printed in Nov., 1878, by the Telephone and Telegraph Construction Co., with its 124 customers. Only 83 of these could reach each other. Many telephones were between the office of an employer and his home.

11. Robert E. Roberts, *Sketches and Reminiscences of the City of the Straits*, Detroit, 1884, 151.

12. *Ibid.*, 116. Roberts also gives the statistics quoted here on the police and fire departments, and the street railways. See Farmer, *op. cit.*, 207, for police.

13. Margaret Ford Ruddiman, *Written Memoir*, IV, 3 Mrs. Ruddiman says that William found Henry at the Flowers' shop. If he waited a week, this would be true. Henry's boarding place was rather near Grand Junction, which suggests that he chose it while still there, hence after a night or two with the Flahertys, who lived at a great distance from the Michigan Car Company.

14 See map of Springwells, *1876 Atlas*. Four roads seem to have met at the Junction. The plant and properties of the Car Company are clearly indicated.

15. "Freight Cars," a clipping in the C. I. Walker Scrapbook, Vol. 5, 62–64, Burton Historical Collection, Detroit Public Library. The clipping is undated, but internal evidence indicates that the account was written and published in 1877.

16. Farmer, *op. cit.*, 804. J. W. Leonard, *The Industries of Detroit*, 99–100, gives the figure of 10,000 cars in 1887.

17. W. J. Cameron, *Reminiscences*.

18. W. A. Simonds, *Henry Ford*, 35.

19. Fair Lane Papers, Box 114, Notes and Diaries.

20. Margaret Ford Ruddiman, Written Memoir, IV.

21. J. W. Leonard, *op. cit.*, 217. He lists them as "makers of stop-valves and fire hydrants"

22. *My Life and Work*, 24; Mrs. Ruddiman mentions the apprenticeship both in her Written Memoir and in her recorded interviews held to supplement this account.

23 The Detroit *Journal* of July 1, 1895, records the death of George Flower and states that James had died nine years earlier—1886. The Detroit *Evening News* of Sept. 30, 1901, carries an item on Thomas's death. He had retired in 1890.

24. Detroit *News*, Sept. 5, 1921: "Detroit Loses Genius' Cradle."

25. Simonds, *op. cit.*, 35–37. This is by far the most detailed account of Henry Ford's work in McGill's, but he himself speaks of working for a jeweler during this period, and his sister and Marvin Buckberry confirm the fact, the latter giving McGill's address. They spell the name "McGill," Simonds "Magill."

26. Accession 42, Box 1, Buckberry Notes, p. 7 of written MS. Ford Archives.

7–278. The
ınufacturers'
· the sale of

31. *Ibid.*, 28.

32. Simonds, *op. cit.*, 37.

33. Fair Lane Papers, Box 118, envelope, Interviews. The statement is given on p. 11 of a 14-page interview, unsigned, previously cited. The four-year period mentioned here is elsewhere spoken of by Ford as a three-year period: *My Life and Work*, 24; and actually he seems to have served less than that.

34. Simonds, *op. cit.*, 37.

35. Farmer, *op. cit.*, 910–915, gives a brief history of the company and pictures of its two plants—the fullest of accounts in the 1880's. It states that S. R. Kirby succeeded G. Campbell of Campbell, Owen & Co. as a partner in the firm, and that in 1872 F. A. Kirby was superintendent at Wyandotte. A list of the boats and ships built appears on p. 914, the largest being the *Boston*, 1880, 1819 tons.

36. *Detroit Journal*, 13th Anniversary Edition, Aug. 1895.

37. Elleine H. Stones, "Frank E. Kirby," *Inland Seas*, VII, winter, 1951, 78.

38. Fair Lane Papers, Box 118, Ford Archives: Interviews. This is a two-and-a-half-page interview, unsigned, and marked "Henry Ford Ad."

39. *My Life and Work*, 24.

40. *Ibid.*, 24.

41. Simonds, *op. cit.*, 38.

42. See Accession 42, Box 1, Ford Archives, p. 7 of Buckberry's brief written account of

Ford's early life, and Mrs. Ruddiman's *Reminiscences*. Mrs. Ruddiman simply says Henry returned "about 1882." Ford himself, in a diary, Accession 1, Box 114, Archives, has the entry: "The Westinghouse Engine," and above it, "1882."

43. Margaret Ford Ruddiman, *Reminiscences*. The 1876 Atlas of Wayne County shows a 40-acre farm in Redford Township near the little town of Redford marked "J. Gleason." It lay about six miles northwest of William Ford's farm, and this was doubtless where Henry Ford's employer lived. Edward F. Monnier in his *Reminiscences* (Ford Archives) states that Ford worked for "Jack Gleason."

44. Selden Case Record, IX, 30–32.

45. The two letters are in Fair Lane Papers, Box 118, Ford Archives: "Henry Ford—Friends & Acquaintances."

46. See Atlas of Wayne County, 1876. There seems to be no doubt as to Mary Catherine Noble's identity, although the letter is signed "M. C. Noble." She had a brother James, knew the Ruddimans, and as to age and initials fits perfectly.

47. Fair Lane Papers, Box 118, as cited in Note 45 above.

48. W. J. Cameron, *Reminiscences*.

49. See genealogical sheets, Accession 23, Box 27, Ford Archives; also Margaret Ford Ruddiman, *Reminiscences*. "My brother, even at an early stage, had a very unprejudiced attitude toward religion. . . . We were taught that . . . it was the way you live and how you use it."

50. Accession 42, Box 1, Marvin Buckberry Records, Ford Archives.

51. *Ibid.* Buckberry adds opposite his entry to this effect for the year 1885: "Museum Records."

52. Selden Case Record, IX, 47.

53. Edward F. Monnier, *Reminiscences*. When Ford left to take a job in Detroit in 1891, says Fred Gleason, who was present when Monnier gave his account, he (Ford) asked Alfred, Monnier's older brother, to run Jack Gleason's engine for him.

CHAPTER VI

The Broadening Stream (*Pages 92–118*)

1. New York *Herald Tribune*, Sept. 29, 1938.

2. Charles E. Duryea to Alfred Reeves, March 25, 1920; Charles B. King Papers, Automotive History Collection, Detroit Public Library.

3. *National Cyclopaedia of American Biography*, XXV, 12.

4. "The Winton Plant and Its Product," *Cycle and Automobile Trade Journal*, VIII, Mar. 1, 1904, 68–79

5. Detroit *Free Press*, Oct. 20, 1901; Pound, *The Turning Wheel*, 34, 46.

6. Charles B. King, *A Golden Anniversary, 1895–1945*. Larchmont, N. Y., 1945, 13; also, interview of May 15, 1952. In this interview, King remarked that his father never discouraged his mechanical interests, that he worked in shops as he grew older, and by the time he entered Cornell had had a pretty varied practical experience.

7. Leland's experience will be described later, as told by his son; the early life of the Dodge brothers is described in Harry Barnard, *James Couzens of Detroit*, MS. (kindly made available by Mr. Barnard); W. L. Grout's early work is referred to by Hugh Dolnar in the *Cycle and Automobile Trade Journal*, IX, July 1, 1904, 56–63; W. A. Patterson is mentioned by Pound, *op. cit.*, 93; the Studebaker brothers and their work are covered in Chris Sinsabaugh, *Who, Me? Forty Years of Automobile History*, Detroit, 1940, 320–321; while "Will Be Leaders," *Motor World*, II, May 2, 1901, 95, tells how Jeffery as the "mechanical head" of Gormully & Jeffery had been a figure in the bicycle industry since 1880.

8. Selden Case Record, XIV, 4219. This shows the *Le Monde Illustré* article in photostat. *La Grande Encyclopédie*, XXIV, 444–450, specifically states that Lenoir's "automobile carriage" was propelled by a motor using carbureted vapor ("a vapeur carburée") and making over 400 revolutions per minute.

9. Lenoir continued to work on engines, and the *Scientific American Supplement* of June 12, 1886, reported on his improved models, one for motor boats.

10. Siebertz, *Gottlieb Daimler*, 64–65. Also Carpenter and Diederichs, *Internal Combustion Engines*, 244–245. Apparently Otto did not recognize the importance of the four-cycle operation in 1861.

11. Donkin, *A Text-Book on Gas, Oil and Air Engines*, 38–40, 605–606.

12. Siebertz, *op. cit.*, 65–68. Siebertz implies (p. 66) that Daimler's role was vital. "It is clear that merely having an idea for an invention is by no means the same as realizing that idea as something industrially workable." However, Siebertz concedes that Otto's role "in the development of the fundamental conception is not in any way lessened." He does not specify a single change or addition made by Daimler, and we can conclude that the latter's contributions were constructional and not basic. Naturally, they were important.

13. Abbott Payson Usher, *A History of Mechanical Inventions*, New York, 1929, 371.

14 Siebertz, *op. cit.*, 68. The Otto was probably licensed in the United States in the late 1870's. Schlier, Schumm & Co. of Philadelphia were the American manufacturers, and the engine was sold "largely in the West," according to the *Proceedings of the Seventeenth Annual Meeting*, 1882, New England Cotton Manufacturers' Association, 45.

15 See Carpenter and Diederichs, *Internal Combustion Engines*, 255–257; Bryan Donkin, *A Text-Book on Gas, Oil, and Air Engines*, 84–85; Dugald Clerk, *The Gas, Petrol and Oil Engine*, I, 34–35; II, 212–214. A two-cycle engine was developed by Clerk, who took out patents in 1877, 1878, and 1881 on three successive engines, the 1881 type coming into considerable use. In 1891 the Day engine appeared, while Robson and Atkinson in Great Britain and Koerting in Germany were also active. After 1890, Clerk concedes, the four-cycle unit was dominant where smaller units were employed; in the field of larger engines the two-cycle types "compete on [illegible] ed desirable in theory, but ex- [illegible]

[illegible] h), originally printed in the [illegible] *nes*, and revised for issue in [illegible] Gewerbe, Vienna. The following account of Marcus is drawn from this monograph.

17. Kurzel-Runtscheiner, *op. cit.*, 23.

18. *Ibid.*, 30. The documents substantiating Marcus's work in detail were in the possession of his patent lawyer, Viktor Tischler, and apparently were part of the materials held by the lawyers for the defense in the Winton Case (the first important case brought in 1900 by the holders of the Selden patent). What may have happened to them will be discussed in Chapter XIII.

19. *The National Cyclopaedia of American Biography*, XX, 222–223, and the *Dictionary of American Biography*, XVI, 567–568. The *Cyclopaedia* article is unsigned; the *Dictionary* article is by Carl W. Mitman. In general, the two accounts agree, and the account given here is modified in a few points by facts brought out in the Selden case record and letters which have been available to the author.

20. *Dictionary of American Biography*, XVI, 568.

21. Barber, *Story of the Automobile*. As a witness in the Selden patent case, Selden described in detail his efforts to get financial support. See Selden Case Record, III, 1180–1185 (May 8, 1906).

22. Selden Case Record, IX, 469–470.

23. Charles E. Duryea to Alfred Reeves, March 25, 1920, as cited in Note 2 above. Duryea adds that he "recognized this engine as being capable of development into the future automobile power."

24. Siebertz, *op. cit.*, 98.

25. *Ibid.*, 116–117. "Der Daimler-Motor verglichen mit dem 'Otto-Motor' und den Übrigen zuvor [illegible] der Leistung wie das Schnellfeuergewehr [illegible] rtz describes the features of Daimler's [illegible] been painstaking, although he quotes [illegible] were made

26. Henry Ford in *My Life and Work*, 24, describes the watch as noted here. Simonds, *Henry Ford*, 39, says that Clara came back from the party and talked with her parents; Catherine

Ruddiman, Margaret's daughter, apparently received about the same account from Clara Bryant Ford. See Margaret Ford Ruddiman, *Reminiscences*.

27. Fair Lane Papers, Box 3, Bryant Genealogy. The Bryant farm is shown on the Greenfield Township map in the 1876 Wayne County Atlas.

28. Margaret Ford Ruddiman, *Reminiscences*. Simonds, *op. cit.*, 38, says Henry met Clara "one New Year's eve" Buckberry (Accession 42, Box 1, p 9 of his brief MS.) places the meeting in 1884, "at a party given by Margaret Ford." Early 1885 seems most logical, making a period of a full year until the two young people reached an understanding—a longer time than Mrs. Ruddiman indicates.

29. Simonds, *op. cit.*, 41. He describes Mrs. Ford as dark, and having "lovely chestnut hair," and credits her with "soft eyes" and a firm chin. Apparently Simonds talked with a number of people who had known Mrs. Ford as a girl.

30. Margaret Ford Ruddiman, *Reminiscences*.

31. Fair Lane Papers, Boxes 2 and 3. Eva was married in California in 1907, and previous to this event had evidently spent rather freely whatever money she earned or could get from her family Just after her marriage she tried to borrow money from the Fords and was much annoyed because Clara told her mother about it.

32. "Where Young Henry Ford Went to Church," Springfield, Massachusetts, *Republican*, June 10, 1928. An unsigned Sunday Supplement article, this account shows that the writer had spent considerable time gathering material in and about Greenfield.

33. Margaret Ford Ruddiman, *Reminiscences*. A sleigh would not have "steel-cut tires" This particular cutter, according to J Bossardet, *Reminiscences*, Ford Archives, was built by a Mr. Utter, who years afterward, at Henry Ford's request, built a replica of it

34. *Ibid.*

35. There would have been no illumination by gas unless the proprietor of the tavern had his own plant, a remote possibility. Those who are interested in details of Ford's youth should examine a poem in the Ford Archives written by Harry McErlean, but based on information furnished by men who had known the industrialist in the 1880's. Written for Ford's seventy-fifth birthday, the verses deal with watchmaking, dancing, and other activities of the period. Many young people who were associates of Henry and Clara are mentioned, among them Christine Gleason ("beauty's queen"), Bill Hunter, Mannie Griffin, James Gleason, Nancy Vizard, Loretta Crane, and William Miller. "Phelps and Brace" are mentioned as musicians, and Bill Cox as caller.

36. Henry Ford in collaboration with Samuel Crowther, *Today and Tomorrow*, Garden City, 1926, 22.

37. Clara Bryant's certificate of confirmation shows that the ceremony took place on April [illegible] [illegible]ie officiated, and Bishop [illegible]

[illegible]rs, Box 1.

[illegible]alling episode may have [illegible]ng.

39. *Ibid.*, 4. "Clara was 'The Great Believer' in Henry from the start of their marriage." See also *My Life and Work*, 30, and W. J. Cameron, *Reminiscences*: "Mr. Ford always called her 'the believer,' you know."

40. Selected Documents, Box 1, Ford Archives.

41. Margaret Ford Ruddiman, *Reminiscences*. "Henry's father, William Ford, gave him eighty acres of land about that time." Marvin Buckberry makes the same statement.

42. *My Life and Work*, 29.

43. Fair Lane Papers, Box 173.

44. Fair Lane Papers, Box 24. Stellwagen was a married man operating a hardware store at St. Ignace, Michigan, on the Mackinac peninsula. Four letters from him to Clara Bryant survive from the 1880's, two in 1885 and two in 1888. These give no information about Clara [illegible] sent him he remarked that "I really think you must [illegible]

[illegible] Archives. The flower may be intended for an orange

47. Margaret Ford Ruddiman, *Reminiscences.*

48. Fair Lane Papers, Bryant Genealogy. As Mrs. Henry Ford, their granddaughter sought for years to trace back her ancestors, and did learn something of the Benches, her mother's family. Martha Bench had been born in Warwickshire, England. No clear-cut connection was found between John Bryant and the various American branches of the Bryant family, many distinguished. One P. O'Connell of Clonmel, S. Tipperary, Ireland, in May and June, 1925, corresponded with Clara Bryant Ford and assured her that the Bryants were O'Briens, and had been kings of Thomond, West Munster, Ireland He offered no proof of any connection with her family, but sent her a coat of arms, for which she apparently paid. Accession 23, Box 33, Ford Archives.

49. Margaret Ford Ruddiman, *Reminiscences.*

50. The St. James Protestant Episcopal Church, which was not Methodist, stood at the corner of Grand River Road and 6th Street, about a mile from City Hall and seven from the Bryant home. Frisbie became rector in 1880 (Farmer, *History of Detroit and Michigan*, 588). The church was simple but dignified in appearance, but scarcely comparable with St. John's, Christ's, or St. Paul's (see illustrations in Farmer).

51. Mrs. Gerecke's comments, which include details about the supper, are all to be found in the article in the Springfield *Republican* cited in Note 32 above.

52 Margaret Ford Ruddiman, *Reminiscences.*

53. *Ibid.*

54. The eighty acres were patented in 1830, changed hands several times, and were sold on July 12, 1865, to William Ford by George Moir of Detroit for $4000, a good price—$50 an acre—in those days. William had just sold his half of his father's former farm for $2500, which would have furnished him most of the cash for the purchase. He paid down $3000, and Moir took a $1000 mortgage, which was cancelled on July 7, 1866 After this is recorded, there are no further notations until the sale in 1903. William may have paid off the mortgage from wood cut from the land; this is Mrs. Ruddiman's assertion. She states in her *Reminiscences* that he did this, and later had a man named Aschenmacher cutting wood for him. He had also rented the place to various tenants, who probably cut some wood.

55. *My Life and Work*, 29. Henry Ford testified to the same effect in the Selden Patent Case in 1904 (Selden Case Record, IX, 33). The "little house" was apparently a simple frame structure of two or three rooms. It stood until the late 1840's, and in 1952 the author was shown the site it had occupied.

56. So Clyde Ford, *Reminiscences*, 21–22, describes the timber on nearby farms.

57 *Ibid.*, 20.

58. Fair
to William
probably to
of 8/4 and
the receipts
years.

59. Margaret Ford Ruddiman, *Reminiscences.* "My brother did a little farming after he married, with the help of his brothers." In her Written Memoir she says: "It was the money from their farm and from his work at the Edison Company that built the first Ford car"

60. On May 19, 1890, Ford borrowed $60.58 from A. Laferty, due July 21. Apparently it was renewed. He paid $25 on Aug. 6, but did not pay the note off completely until Oct. 10, 1894.

61. Accession 105, Ford Archives. On June 29, 1892, Henry Ford purchased from John Adam Moeller for $350 lot 91 of Moeller's subdivision. This was on Moeller Avenue (later Philadelphia Avenue) near Russell. Ford took a loss when he sold the property to the McLellan and Anders

house, the Moir house,

ank Campsall, Oct. 19,
nber that Mr. Ford cut

from his own land." See Note 59 above. The Deinzer furniture company apparently supplied the furniture, either for elm strips or other lumber.

65. Sarah T. Bushnell, *The Truth About Henry Ford*, 37. She also says that William Ford gave them "an old-fashioned English clock."

66. Clyde Ford, *op. cit.*, 21.

67. Selden Case Record, IX, 33. Testimony of July 8, 1904.

68. *My Life and Work*, 28–30.

69. Benson, *The New Henry Ford*, 47.

70. *My Life and Work*, 26–27. These pages contain an interesting and thoughtful commentary on the general factors involved in locomotion by steam. If Ford really considered all of them at the time he at least had a fine conception of what was needed and what were the chief obstacles. One cannot help feeling that his ideas in the 1880's were less penetrating than his description of them in the 1920's.

71. Selden Case Record, IX, 47. Testimony of Aug. 9, 1904.

72. Margaret Ford Ruddiman, Written Memoir, V, 3.

73. *Ibid.*, V, 8. Mrs. Ruddiman tells of Clara Ford going to the bank in the mid-1890's to draw out some money that Henry needed. The implication is that she took care of all such matters.

[illegible] .00.

[illegible] 887

on, although the Olds, manufactured in 1885, did not advertise, and the Sintz, dating from the same year, not until later.

77. Detroit *Free Press*, Oct. 20, 1901.

78. "The Bicycle," *Scientific American*, LXXV, July 25, 1896, 68–69.

79. Margaret Ford Ruddiman, *Reminiscences*. A. M Smith, who assisted Mrs. Ruddiman in the preparation of her written memoir, says that Ford repaired the engine; Marvin Buckberry (Accession 42, Box 1, Ford Archives) says merely that he saw it.

80 Margaret Ford Ruddiman, *Reminiscences*. Marvin Buckberry, in his unfinished account of Henry Ford and the Ford Motor Company (as cited in the preceding note) says that Wilde was the man who procured the job for Henry. He also gives the Fords' first residences in Detroit, mentioned later.

81. *My Life and Work*, 30.

82. Fair Lane Papers, Box 114, Notes and Diaries—"went to Detroit Sept. 25, 1891 (Mr. & Mrs.)."

CHAPTER VII

The Eve of Revolution (*Pages 119–141*)

1. Accession 42, Box 1, Ford Archives, Marvin Buckberry Records, p. 12 of MS.

2. Detroit *Free Press*, Jan. 15, 1890.

3. George B. Catlin, *The Story of Detroit*, Detroit, 1923, 602–607. A proposal for the plant was submitted to the voters in 1893 and approved by 15,282 to 1245.

4. Burton, *History of Wayne County and the City of Detroit*, I, 360, gives date of organization. Services commenced in Nov., 1886. The 13th Anniversary Edition of the Detroit *Journal*, August, 1895, gives data on service to residents for that year.

5. Detroit *Journal*, 13th Anniversary Edition, Aug., 1895.

6. *Compendium of the Eleventh Census: 1890*, Part II, 802–804.

7. See J. W. Leonard, *The Industries of Detroit*; James P. McKinney, compiler, *The Industrial Advantages of Detroit*, Detroit, 1890; and the *Evening News* for this period.

8. Detroit *Evening News*, November 11, 1895. Of 237,798 inhabitants, the total foreign born were 94,849, the Germans 39,160 and the Canadians 26,233.

9. Detroit *Sunday News*, July 3, 1892.

10. Burton, *op. cit.*, I, 366.

11. Detroit *Evening News*, March 23, 1891.

12. Detroit *Sunday News*, June 21, 1891; and Jan. 4, 1891.

13. George Truman Kercheval, "Give Us Good Roads," Detroit *Free Press*, June 16, 1892.

14. Detroit *Free Press*, Jan. 15, 1890.

15. Detroit *Evening News*, May 4, 1892.

16. Detroit *Sunday News*, June 21, 1891.

17. Detroit *Sunday News-Tribune*, Nov. 2, 8195. This article shows that the development had begun in the early 1890's. Some Detroiters were already building farther out, in Highland Park, incorporated as a village in 1889. (*News-Tribune*, Nov. 17, 1895)

18. Catlin, *op. cit.*, 567; Detroit *Sunday News*, Oct. 4, 1891. Oliver E. Barthel, in an interview of Oct. 28, 1952, told of the fishing and sports on the island.

19. "Saw the Boulevard," Detroit *Free Press*, Sept. 11, 1892. For the history of the movement to construct it, see Burton, *op. cit.*, I, 376–378.

20. Detroit *Free Press* and Detroit *Evening News* of July 17, 1891.

21. Journalists, engineers, and doctors all joined during these years in praising the health-giving aspects of cycling and its contributions to transportation. An advertisement for *Outing* in the *Scientific American* for Jan. 25, 1896, shows a cyclist, a hiker, a girl photographer, a fisherman, a yacht, and a tennis player as symbols of sport.

22. Henry Ford's accounts, Fair Lane Papers, Box 78, show that he paid a deposit on a bicycle on Feb. 10, 1893. This is of course not necessarily his first.

23. St. John C. Nixon, *The Invention of the Automobile: Karl Benz and Gottlieb Daimler*, London, 1936, 43–48. Although Nixon was writing for a company that had absorbed both the Benz and Daimler interests, he is definitely a Benz partisan, as Siebertz is partial to Daimler. The degree of bias is comparable, and both seem scrupulous about the facts, though each accepts the unsupported statements of his hero for private tests, etc.

24. Nixon, *op. cit.*, 75–76.

25. "A Gas-propelled Carriage," *Scientific American*, LX, Jan. 5, 1889, 9 The article is from the *Illustrierte Zeitung*, date not given. In the *Supplement*, XXIII, Jan. 1, 1887, 9169, appears a description of Benz's motor taken from *La Nature* (no date).

[illegible]. Nixon, *op. cit.*, 79–82. The Benz [illegible] quoted from the *Illustrierte Zeitung*, claimed a speed of only 10 m.p.h., but could doubtless better this somewhat.

29. *Scientific American*, LIV, March 6, 1886, 151, on Palmer; *ibid.*, March 20, 185, for Bollée; *ibid.*, LXII, Feb. 11, 1888 82, for Volk's carriage.

30. *Ibid.*, LIX, Oct. 6, 1888, 215. The article is quoted from *The Engineer*.

31. See Siebertz, *op. cit.*, *passim*.

32 Cf. Paul N. Hasluck, *The Automobile*, based upon Gérard Lavergne's *L'Automobile sur Routes*, London, 1904.

33. Siebertz, *op. cit.*, 162–167.

34. *Ibid.*, 172.

35.U. S. Circuit Court, Southern District of New York: Electric Vehicle Co. and George B Selden *vs.* Société Anonyme des Anciens Etablissements Panhard et Levassor and André Massenat. Selden Case Record, XX, 2637, 2645–2646; testimony of Arthur Constantin Krebs, Director of Panhard & Levassor, October 31, 1906. Hereafter cited as "Selden Patent Case (Panhard)." For interesting material on the Panhard automobile, see Selden Case Record, XIV, 4159 ff.

36. Nixon, *op. cit.*, 89–93.

37. Hiram Percy Maxim, *Horseless Carriage Days*, New York, 1937, 1–3.

38. Selden Case Record, XVIII, 1474–1477, Dec. 4, 1905.

39. *National Cyclopaedia of American Biography*, XXV, 12.

40. J. Frank Duryea, *America's First Automobile*, Springfield, Massachusetts, 1[illegible]2, 1–3.

41. Selden Case Record, XVIII, 1164 ff. Oct. 24, 1905.

42. Haynes' biographer in the *National Cyclopaedia*, cited above, states that he bought a

Sintz motor for use in his car. He probably regarded that as more easily adaptable than the Otto, and did not realize that he might have procured a Daimler motor in New York. No American inventor seems to have considered this excellent power plant.

43. Maxim, *op. cit.*, 4–5.

44. Charles E. Pratt, "A Sketch of American Bicycling and Its Founder," *Outing*, XVIII, July, 1891, 342–349.

45. Herman F. Cuntz, "Hartford the Birthplace of the Automobile Industry," Hartford *Times*, September 16, 1947.

46. *Outing*, XVIII, as cited in Note 44 above.

47. *Annual Report of the Commissioner of Patents for the Year 1897*. Washington, Government Printing Office, 1898.

48. Pound, *The Turning Wheel*, 73–75; Sinsabaugh, *Who, Me?*, 320–321.

49. Claude Sintz, *Reminiscences*, Ford Archives.

50. A description of plans for the Olds plant, soon to be erected, in the Detroit *Free Press*, May 14, 1899, lists stationary and marine gas engines as well as "automobiles, including motor carriages and motor trucks," as future products. Detroit *Journal*, May 13, 1899

51. *Motor Age*, May 3, 1900, and *The Detroiter*, Sept., 1913 ("The Gasoline Engine").

52. Selden Case Record, XVIII, 1451–1455 (Henry Ford's testimony), and IX, 80–83 (Huff's testimony).

53. Accession [illegible]

material, 12–13 of MS.

yment"

urday Evening Post for May 16,

1931, "It Doesn't Pay to Pioneer," Charles set the earlier date.

56. J. Frank Duryea, *op. cit.*, 1–2.

57. *Ibid.*, 3–17.

58. *Ibid.*, 18–20.

59. For Olds' steam carriage, see Note 38 above; p. 913 describes the machine (steam) shipped to Bombay. Maxim's machine is described in Chapter IV, *Horseless Carriage Days*; Haynes's in the *National Cyclopaedia* article on, and probably by, him (Note 39 above), and also in Maxwell's testimony, Selden Case Record, IX, 662–677. For Morrison, see *Scientific American*, LXV, Jan., 1892, 18.

60. Siebertz, *op. cit.*, 274. The lines were written in 1897.

61. *Scientific American Supplement*, XXXVII, Oct. 6, 1894, 15,648. Also, *Supplement*, XL, Aug. 10, 1895, 16,344. Quotation is from this article.

62. *Scientific American* LXXIII, July 20, 1895.

63. J. Frank Duryea, *op. cit.*, 20–21; also *Scientific American*, LXXIII, Nov. 9, 1895, 293. Charles Duryea was a passenger.

64. J. Frank Duryea, [illegible]

r a name likely to be used for such vehicles, and

The Haynes car smashed a front wheel in making a sharp turn to avoid a streetcar while on its way to the starting point.

67. Charles B. King, *A Golden Anniversary, 1895–1945*, 17. King, as an umpire and a devotee of automotive progress, gives a full account of the race in general, and of his own part in it.

68. *Horseless Age*, I, Feb., 1896, 19.

69. A. J. Wallis-Taylor, *Motor Carriages or Power Carriages for Common Roads*, 1897; quoted by Pound, *The Turning Wheel*, 38.

70. King, *op. cit.*, 41–43.

CHAPTER VIII

A Horseless Carriage (*Pages 142–168*)

1. Margaret Ford Ruddiman, *Reminiscences*.

2. Accession 42, Box 1, Ford Archives, Marvin Buckberry records, p. 14 of MS., also Simonds, *Henry Ford*, 46.

3 Marvin Buckberry records, as cited above; Simonds, *op. cit.*, 47, quotes the final comment from Ford.

4. Fair Lane Papers, Box 177, Ford Archives. A receipt for $12.50 "as rent for room" (no address), dated July 25, 1892, is signed "A. J. Seinzer."

5. *Ibid.* The Forest Avenue address is sometimes given as 125 and 525, but while the first appears on one receipt, others give 570, and this appears to have been Mrs. Ford's recollection of the correct number.

6. The address is given in the 13th Anniversary Number of the Detroit *Journal*, Aug., 1895.

7. Selected Documents, Box 1, Ford Archives. Statement by Rex Waddell dictated after an interview with Mrs. Ford, apparently in the 1920's. One of Ford's diaries reads: "Moved to 58 Bagley about Dec 15, 1893. . . . Was at that time Chief Engineer of the Edison Co. Must live close [illegible] Plant." This of course was jotted down by Henry Ford years after the event, but [illegible] doubtless correct.

8. Simonds, *op. cit.*, 46, describes the shed, saying that Ford had a lathe in it. Charles B King also mentions it as being used by Ford in 1895–96, both in his interview for the *New Yorker*, soon to be cited, and in his *Psychic Reminiscences*, published by the author, 1935.

9 King, *A Golden Anniversary, 1845–1895*, 8, 12–14. Additional details are supplied from an interview at Larchmont, New York, May 13, 1952. Claude Sintz (*Reminiscences*) gives the approximate date when King ordered the engine. Apparently it was not delivered until late September or early October; King remonstrated in September about the failure to deliver. The engine had a three-by-three-inch cylinder, apparently only one.

10. Charles B. King Papers, Automotive History Collection, Detroit Public Library, interview of Jan. 22, 1940, probably conducted by Dr. Milo M. Quaife.

11. Oliver E. Barthel, interviews of June 11, 1952, and Oct. 28, 1952, the latter tape-recorded. Barthel describes the workers at the Lauer shop, particularly Edward Verlinden, whom he pronounced the best lathe operator he ever knew. Barthel felt that the Lauer shop did work comparable with Leland [illegible] Faulconer's. Lauer executed all King's orders to specifications, observing the finest tolerances in the finished work.

12. Oliver E. Barthel, *Reminiscences*, Ford Archives.

13. Brendan Gill, "To Spare the Obedient Beast," *New Yorker*, XXII, May 18, 1946, 54

14. Accession 42, Box 1, Ford Archives, Marvin Buckberry records, p 14 of MS. This statement is made also by Simonds, *op. cit.*, 47.

15. Gill, *op. cit.*, 35. Again, in a letter to Charles E Duryea, July 15, 1915, [illegible] the Detroit Public Library's Automotive History Collection, King says that Ford's first motor was tried out late in 1895. He claimed to have been present at the first trial.

16. King to Cato, Oct. 2, 1930, and Cato to King, Feb. 15, 1931; in King Papers, as cited above. Cato told Ford that he was interested in making a motor for a boat, and that Ford could build one for a car.

17. Simonds, *op. cit.*, 47–48.

18. *Ibid.*, 49. "When mounted in position it proved to be too powerful for the wheels [of the bicycle on which Ford meant to use it] and he abandoned the idea, [illegible] undertake a more ambitious one in which the engine would be made to drive a four-wheeled carriage."

19. Barthel, Interview of Oct. 28, 1952.

20. King, *A Golden Anniversary*, 45. The Fisher of this firm is not to be confused with the Fishers later to appear as the Fisher Body Company. Three of these—Fred, Edward, and Charles—had their first contacts with automobiles a few years later, as employees of the C. R. Wilson Co.

21. Barthel, *Reminiscences*.

22. Detroit *Free Press*, March 7, 1896; Detroit *Journal*, same date. Except for the first statement credited to the *Free Press*, the other facts and quotations are from the *Journal*.

23. Detroit *Tribune*, March 8, 1896. The relative apathy of the press to a real demonstration shows that fiction was still more exciting than truth.

24. Barthel, Interview of Oct. 28, 1952.

25. *Ibid.*; see also Barthel's *Reminiscences* for additional details.

26. King, *A Golden Anniversary*, 14.

27. According to Barthel, Ford followed the King wagon on March 6, and the Duryea car in April, when some preliminary tests were made with it.

28. This photograph is in the Detroit Public Library's Automotive History Collection.

29. Simonds, *op. cit.*, 48.

30. *Ibid.*, 49.

31. *Ibid.*, 51; one of Ford's diaries in the Ford Archives bears the notation, in connection with his move to Bagley Ave.: "Had Independent *Phone*."

32. *My Life and Work*, 30.

33. James W. Bishop, "The First Ford Car," mimeographed sheet in Charles B. King Papers, cited above, which Bishop endorsed: "This was broadcast over Station W.X.Y.Z. at 10:40 P.M. Sat. Oct. 9–48."

34. *Ibid.*

35. Charles B. King to Charles E. Duryea, June 2, 1927, King Papers, as cited above. In this letter King refers to Pennington as a "fakir." While King makes no specific statement that Ford improved on the Pennington model, if we accept his account of trips in the first Ford car, we must assume that some improvement, and probably a considerable one, had been made.

36. King, *A Golden Anniversary*, 14.

37. *Ibid.*, 44.

38. *My Life and Work*, 31. "The power was transmitted from the motor to the countershaft by a belt and from the countershaft to the rear wheel by a chain." This is all we actually know about the transmission. However, Ford as he testified in the Selden Case Record, XVIII, 1463, was familiar with belt transmission from his experience with the Westinghouse traction engine. It would have been natural for him to have planned an all-belt transmission, then to have studied the Duryea car and decided to incorporate the chain, and we have King's word that he ordered a chain for Ford. In his testimony cited above, Ford referred to the combination of belt and chain being used by a Benz, but we have no evidence that he saw the latter car, while he did see the Duryea. The best opportunity for his seeing a Benz would have been on his visit to New York in Aug., 1896, when he attended a convention there, as will be described. He appears not to have modeled his transmission on that of King's wagon, which according to Barthel (*Reminiscences*) employed a shaft drive.

39. Bishop, as cited in Note 33 above.

40. So both Ford and Huff testified in the Selden Case Record, XVIII, 1452, Henry Ford's testimony, and IX, 81, Huff's.

41. Ford describes his first car in *My Life and Work*, 30–31. He evidently does not describe the vehicle as it was when it made its first run, but as it was after improvements had been made.

42. *My Life and Work*, 31.

43. Selden Case Record, IX, 60.

44. So King said (and Simonds writes to the same effect, and Ford himself acknowleged the gift at various times) on Jan. 17, 1940. (King Papers, as cited above.) King took pains to deny Barthel's assertion that *he* had picked up the discarded valves and given them to Ford. "I would like to correct that. . . . I gave them to him." King said there were four valves, not two.

45. Charles T. Bush, *Reminiscences* (with those of Claude Sintz), Ford Archives. King mentions the $15 limitation on credit in his *Psychic Reminiscences*, 18. He also says that Ford was behind in his rent.

46. Barthel, *Reminiscences*.

47. Simonds, *op. cit.*, 51.

48. Margaret Ford Ruddiman, Written Memoir, V, 8 of original version.

49. Simonds, *op. cit.*, 51.

50. Nettie Bryant (Mrs. Louis C.) Scott, *Reminiscences*, Ford Archives.

51. Bishop, as cited in Note 33 above.

52. Charles T. Bush, as cited in Note 45 above.

53. Simonds, *op. cit.*, 52. King also mentions this incident in the account he gave Brendan Gill of the *New Yorker* (Note 13 above), but of course by 1946 this detail was part of a legend.

54. Bishop, as cited above.

55. Simonds, *op. cit.*, 53.

56. *Ibid.* The following conversation is as Simonds gives it. According to the only receipt we have for rent paid on 58 Bagley Avenue, the money was paid to Oscar M. Springer. This was on June 1, 1894. There could be many explanations to account for the difference in names. Simonds is followed in this instance, as he probably got his information from the Fords.

57. *Ibid.*, 54. Obviously, there were cars kept in buildings before this, and there is no certainty that in one or more cases special doors had not been built.

58. David M. Bell, *Reminiscences*, Ford Archives. Although eighty-nine years of age when he described these experiences, Mr. Bell, according to the interviewer, had a very clear recollection of them.

59. Nettie Bryant Scott, as cited in Note 50 above.

60. Margaret Ford Ruddiman, Written Memoir, IV, 1.

61. Brendan Gill, *op. cit.*

62. Selden Case Record, XVIII, 1465–1466.

63 Simonds, *op. cit.*, 55. Ford told Simonds about this visit. "It must have been around election time, for we had a picture of him in the window."

64. *My Life and Work*, 33.

65. *Ibid.*

66. Simonds, *op. cit.*, 55–56.

67. J. Frank Duryea, *Who Designed and Built Those Early Duryea Cars?*, 1944, 10

68. J. Frank Duryea, *America's First Automobile*, 24–25.

69. *Ibid.*, 27–29.

70. *Ibid.*, 30–32.

71. Alfred P. Sloan, Jr., with Boyden Sparkes, *Adventures of a White-Collar Man*, New York, 1941, 24–27.

72. "The Winton Plant and Its Product," *Cycle and Automobile Trade Journal*, VII, March 1, 1904, 68–79 Haynes-Apperson seem also to have made regular sales before Winton, but more than any other sale this particular one may have inaugurated steady manufacture.

73. *Horseless Age*, I, Nov., 1895, 8.

74. Brendan Gill, *op. cit.*, 40.

75. This little "puff" is quite as long as the news account of King's first successful run more than five months earlier.

76. I, 23.

77. King, *A Golden Anniversary*, 14; Barthel, Interview of June 11, 1952 (remarks on the Duryea motor).

78. Barthel, *Reminiscences.*

79. Simonds, *op. cit.*, 57. The payroll of the Edison Company in 1896, March 15, shows that Henry Ford, highest paid of those listed, received only $100 a month. *Fair Lane Papers*, Box 118, "Henry Ford—Employment"

80. Selected Documents. Box 1. Ford Archives. A clipping from the *Electrical World* of Au [illegible]

[illegible] response.

84 *My Life and Work*, 33.

85. Selected Documents, Box 1, Ford Archives Hall wrote from 55 Woodward Ave., Detroit, on April 11.

CHAPTER IX

Time of Experiment (*Pages 169–191*)

1. *My Life and Work*, 33.

2. *Ibid.* Ford says here that his second car was lighter than the first, but this was not true, although parts of it, unit for unit, were. However, he was thinking of lightness, for when the new car was finished, he took pains to emphasize its relatively low weight.

3. *Ibid.*, 34.

4. Selected Documents, Box 1, Ford Archives.

5. Charles B. King, *Psychic Reminiscences*, 12. King quotes Ford on this point, apparently from a letter.

6. Fair Lane Papers, Box 177.

7. Fair Lane Papers, Box 79, Ford Archives.

8. Selected Documents, Box 1, Ford Archives.

9. *Ibid.*

10. *Ibid.*

11. *Horseless Age*, III, Nov., 1898, 22.

12. *Scientific American*, LXXVIII, May 14, 1898, 309. Winton's record was 1:48.

13. The reverse was mentioned in an account of the improved car Ford produced early in 1900, and the presumption is that he had it five months earlier.

14. J. Bell Moran, *The Moran Family*, 126. Moran was Murphy's son-in-law. He inherited the log of the latter's first trip with Ford.

15. Detroit *Free Press*, Aug. 6, 1899; Barthel, *Reminiscences*; Milo Quaife, *The Life of John Wendell Anderson*, Detroit, 1950. See also list of directors on advertising brochure, selected documents, Ford Archives. A number of the stockholders were prominent Detroiters. Black, a hardware merchant, had been the Republican nominee against Maybury; McMillan's family were owners in the Michigan Car Co.

16. *My Life and Work*, 34.

17. Detroit *Journal*, June 6, 1896.

18. Detroit *Journal*, Dec. 8, 1897; April 15, 18, June 20, July 13, 1898.

19. Fair Lane Papers, Box 118, Ford Archives. Script of a 5-min. talk by Dow on the radio.

20. *My Life and Work*, 34–35.

21. Simonds, *Henry Ford*, 61.

22. Radio talk, cited above.

23. Simonds, *op. cit.*, 61.

24. *My Life and Work*, 35.

25. Radio talk, cited above.

26. *My Life and Work*, 36. He was listed as one. See Barthel, *Reminiscences*.

27. Selected Documents, Box 1, Ford Archives. An assignment was drawn up at some time after Sept. 12, the date for the filing of Patent No. 730,222, which is noted. However, this document is unsigned. Subsequent references to patents nevertheless indicate that it was carried out.

28. Fair Lane Papers, Box 79. Two bills, for $120.50 and $106.15, were presented on that date. Bills survive for this period from other companies: electric, foundry, sheet lead, etc.

29. Detroit *Free Press*, Aug. 19, 1899.

30. Detroit *Journal*, Sept. 25, 1899.

31. Detroit *Journal*, Feb. 16, 1900. "The average time by horse and wagon between the post-office building and Station A, out Woodward Avenue, is about 22 minutes. The automobile went out to the station loaded to the gunwales, in six minutes and returned in five. The time by horse and wagon between the post-office and the station out Jefferson Avenue is about 30 minutes. The automobile went out in eight minutes."

32. *Ibid.*, Sept. 16, 1899.

33. Detroit *News-Tribune*, Feb. 4, 1900.

34. William Walter Pring, *Reminiscences*, Ford Archives.

35. Detroit *News-Tribune*, Feb. 4, 1900.

36. Pring, interview cited above. Milo Quaife, *op. cit.*, says two.

37. *My Life and Work*, 37.

38. Selden Case Record, XVIII, 1465.

39. The period Pring describes may be 1901 rather than 1900, but the earlier time seems to be indicated. For example, Pring speaks of the wheels as "artillery type with wood spokes and fillets." In 1901 a picture of the car then being sold shows that it had steel wire spokes radiating from both sides of the hub.

40. Interview of Feb. 5, 1952, p. 87.

41. Herman F. Cuntz, "Hartford the Birthplace of Automobile Industry," Hartford *Times*, Sept. 16, 1947.

42. Russell Stone, "The Columbia Chainless: The Authentic Story of a Marvellous Achievement," *McClure's Magazine*, X, Nov., 1897, i–viii (separate brochure). Also Maxim, *Horseless Carriage Days*, 28, and throughout this book for Eames's work and character.

43. Cuntz, *op. cit.*

44. *American Machinist*, XVIII, Oct. 3, 1895, 781.

45. "A Trip Through a Large Bicycle Factory," *Scientific American*, LXXVII, Nov. 6, 1897, 292–293.

46. Fred H. Colvin in collaboration with D. J. Duffin, *60 Years With Men and Machines: An Autobiography*, New York, 1947, 88.

47. J. Frank Duryea, *America's First Automobile*, 19.

48. F. L. Smith, "Motoring Down a Quarter-Century," *Saturday Night*, XXII, Sept. 29, 1928, 7.

49. Detroit *Journal*, May 13, 1899: "A New Factory to be Located in Detroit." The Olds car was then envisaged as a 1100-lb. machine. A year later Olds conceived his 580-lb. runabout.

50. The reader can find an excellent account of the experimental work of the Pope firm in Maxim's *Horseless Carriage Days;* unfortunately little is said about quantity manufacture, either of the electric or the gasoline types. However, Col. Pope's first question about the first electric was what it had cost, and how much this could be reduced by mass production.

51. Barber, *Story of the Automobile*, 95. In general, Barber is not accurate, but seems to be fairly so about these cars.

52. Duryea, *America's First Automobile*, 25. Floyd Clymer, in *Early American Automobiles*, New York, 1952, 4, presents a picture of the Duryea shop which, while cluttered, shows a well-organized activity, with dozens of workers and a complex of bench work and small machine tools.

53. *Scientific American*, LXXVIII, May 14, 1898, 309.

54. Pound, *The Turning Wheel*, 54. The *Free Press*, April 22, 1900, notes that "Charles B. King, an employe of this [Olds] firm, produced the first automobile ever seen in Detroit."

55. Pound, *op. cit.*, 54–55.

56. *My Life and Work*, 36. The only publicity the automobile achieved after February was ac [illegible] hour, at [illegible] omas, a [illegible] enger a [illegible] wild" w [illegible] and fetched up against a tree." (*Journal*, June 2, 1900.)

57 *Ibid.*, Nov. 30, 1901. The paper referred to the collapse as happening "about a year ago." Quaife, *op. cit.*, 81, cites January as the official date of demise.

58. *My Life and Work*, 36.

59. Detroit *Journal*, May 30, 1899.

60. *Free Press*, Oct. 6, 1901. The *Scientific American* of June 23, 1900, reports the Paris-Lyons race, held June 14. Charron negotiated the 351-mile distance at an average speed of 38 4 m.p.h.

61. *Free Press*, Dec. 1, 1901. Speaking of the formation of a company [illegible] succeed the Detroit Automobile Co., the paper says: "When the old company went out of existence he furnished the funds for Ford to continue his experiments and when the first machine was completed it had cost him several thousand dollars." Murphy was later to be joined by others in starting a second company, and some of these—Black, White, and Bowen—may have helped earlier to finance Ford.

CHAPTER X

Racing: A Prelude (*Pages 192–219*)

1. Selden Case Record, XVIII, 1466.

2. Fair Lane Papers, Box 135, supplies information on the loan to John. For Clara's diary,

see Box 92. The diary covers only the first five nomths of the year. Mrs. Ruddiman, in her Memoir based on interviews, notes that the Fords moved in with her father, but is unsure which of the above residences he then occupied.

3. Oliver E. Barthel, *Reminiscences.* Barthel mentions the location of the shop which is given on p. 192.

4. *Census of Manufactures 1905. Automobiles and Bicycles and Tricycles. U. S. Bureau of the Census, Bulletin 66.* Washi [illegible] 57—there were probably more. [illegible] *Topics*, II, Dec. 15, 1900, 317–[illegible] now." Much of the industry was made up of speculative or experimental undertakings.

5. J. T. Sullivan, "New England a 1900 Leader," *Motor Age*, XIX, March 2, 1911, 2. Sullivan's figures are in excess of the Census report, which gave 3723.

6. *Horseless Carriage Days*, 169.

7. *Scientific American*, LXXXI, Aug. 5, 1899, 92, describes the race.

8. *Ibid.*, LXXXII, April 28, 1900, 259; LXXXIII, Sept. 8 and 15; and Oct. 6, 1900.

9. *Ibid.*, LXXXIV, June 29, 1901, 402, and LXXXV, Aug. 3, 1901, 71.

10. *Ibid.*, LXXXV, July 27, 1901, 55.

11. *Ibid.*, LXXXV, Sept. 28, 1901, 194.

12. William Brown Meloney, "The Marvellous Growth of the Automobile Industry in America," *Munsey's*, XLII, Oct., 1909, 21. Meloney says that in 1902 the United States imported 265 cars. For 1900 the total was probably less.

13. *Automobile Topics*, I, Nov. 10, 1900, 119.

14. Henry Ford's experience with the *Detroit Automobile Company* was typical of faltering [illegible] were apt with their fingers—men who could plug holes in cast-iron cylinder [illegible] spark plugs and make a conglomeration of ill-fitting parts run." (Charles F. Kettering and Allen Orth, *The New Necessity*, Baltimore, 1932, 11.)

15. *Scientific American*, LXXXI, Oct. 18, 1899, 282.

16. *Ibid.*, LXXXII, Jan. 6, 1900, 22.

17. *Ibid.*, LXXXII, Jan. 13, 1900, 22.

18. Detroit *Evening News*, Oct. 3, 1900.

19. *Scientific American*, LXXX, Feb. 18, 1899, 101.

20. Chris Sinsabaugh, *Who, Me?*, 54–56. While in general his book is anecdotal and discursive, Sinsabaugh, who managed a Chicago show in March, 1901, gives a detailed account of the New York show, apparently based on records.

21. Edwin Emerson, Jr., "Newport in the Lead," *Automobile Magazine*, I, Oct., 1899, 5–16.

22. "The Automobile in Society," *Automobile Topics*, I, Oct. 20, 1900, 11; also Oct. 27, 43–44, and issues of Nov. 3 and Nov. 17.

23. Detroit *News-Tribune*, Oct. 28, 1900.

24. Barthel, *Reminiscences.*

25. Fair Lane Papers, Box 92, Ford, Clara—Clothing, Diaries. Except for the letters noted below, the diary is the source of information in this section.

26. Kate Bryant Raymond to Milton D. Bryant, Aug. 18, 1901, Accession 102, Box 1, Ford Archives. "We think it is about 80 miles from here to Det." Henry and Clara had driven to Jasper "on Auto," making the return trip in six hours, with three stops, including one for lunch.

27. Selected Documents, Box 1, Ford Archives. There are three letters written from Jasper, all in this box.

28. Kate Bryant Raymond to Milton D. Bryant, Aug. 18, 1901.

29. Detroit *Evening News*, Sept. 9, 1901.

30. Detroit *Journal*, May 11, 1901.

31. Detroit *Free Press*, Oct. 6, 1901.

32. Simonds, *Henry Ford*, 69. Clara wrote to her brother Milton on December 3, "He rec'd a beautiful cut glass punch bowl for winning his first race." Accession 102, Box, 1, Ford Archives.

33. He was then presumed to have spent the money himself. Later, and by some earlier, Murphy was properly credited as the backer.

34. Detroit *Free Press*, Oct. 6, 1901.

35. Detroit *Evening News*, Oct. 10, 1901.

36. Detroit *Free Press*, Oct. 11, 1901.

37. *Ibid.*

38. *Motor World*, III, Oct. 17, 1901, 64.

39. Detroit *Tribune*, Oct. 11, 1901.

40. Detroit *Free Press* and Detroit *Tribune*, Oct. 11, 1901.

41. Clara Bryant Ford to Milton D. Bryant, Dec. 3, 1901. Accession 102, Box 1, Ford Archives.

42. Detroit *Journal*, Feb. 14, 1900.

43. Detroit *Free Press*, Nov. 18, 1900.

44. Detroit *Journal*, Oct. 11, 1900.

45 Oldfield later said that Cooper lent him a motorcycle tandem in the spring of 1902, and that he then went to Salt Lake City, apparently from Detroit. Oldfield to Chris Sinsabaugh, March 29, 1914. David Beecroft Papers, Automotive History Collection, Detroit Public Library.

46. Detroit *Evening News*, Oct. 24, 1901.

47. Detroit *Free Press*, Nov. 20, 1901.

48. Detroit *Journal*, Nov. 30, 1901; Detroit *Free Press*, Dec. 1, 1901; Quaife, *op. cit.*, 82.

49. Detroit *Journal*, Nov. 30, 1901.

50. Sloan, *Adventures of a White-Collar Man*, 41–42; 71. This account does not name the year, but 1901 seems indicated.

51. Fair Lane Papers, Box 131, Ford Archives.

52. Louis C. Scott (*Reminiscences*, 29, Ford Archives) remarked: "Mrs. Ford told me that when Mr. Ford got home at night his father would like to ask him a lot of questions. Mr. Ford didn't like that, and he was tired."

53. Clara Ford to Milton Bryant, Dec. 3, 1901.

54. Fair Lane Papers, Box 131, Ford Archives.

55. Sieberling, as cited in Note 51 above.

56. Barthel, *Reminiscences*.

57. Jan. 6, 1902. Accession 102, Box 1, Ford Archives.

58. Jan. 6, 1902. Accession 102, Box 1, Ford Archives.

59 Barthel, *Reminiscences*.

60. Keith Sward, *The Legend of Henry Ford*, New York, 1948, 14, presents this view, quoting MacManus and Beasley, *Men, Money, and Motors* (see Chapter XI, Note 35). Pound, *The Turning Wheel*, 103, comments to the same effect.

61. *My Life and Work*, 36.

62. Pring, *Reminiscences*, Ford Archives. Early advertisements published in the *Scientific American* show the firm's original name to have been Leland, Faulconer & Norton; Norton soon dropped out.

63. This is essentially the informal account given on May 29, 1952, of his father's work by Wilfred C. Leland; it corresponds with articles in the Detroit papers and the testimony of men like Alfred P. Sloan, Jr. The process by which the Columbia chainless gears were made involved special steel, allowance for warpage which occurred in stamping out the units, and special grinding techniques.

64. Pring, *Reminiscences*.

65. *My Life and Work*, 36. Barthel, *Reminiscences*. As a witness in the Selden Patent Case, Selden Case Record, IX, 33, Ford said he left the Company on March 10, 1902.

66. Detroit *Journal*, Sept. 13, 1902.

67. *My Life and Work*, 37.

68. Simonds, *op. cit.*, 74.

69. Sloan, *op. cit.*, 73. *Automobile Topics*, LIII, March 22, 1919, 783–784; conversation with Harold Wills, Jr., March 11, 1953. Wills's full name, Childe Harold Wills, suggests that parents had read Byron.

70. Sloan, *op. cit.*, 74; conversation with Harold Wills, Jr.

71. Wandersee says he began work on Oct. 17, 1902, and that the racer was then completed.

72. *My Life and Work*, 50.

73. Correspondence of Milton D. Bryant with S M. Butler, secretary, American Automobile Association. Accession 102, Box 1, Ford Archives.

74. *My Life and Work*, 50.

75. *Ibid.*, 52.

76. Simonds, *op. cit.*, 75; *My Life and Work*, 51. "It took us only a week to teach him how to drive." Oldfield in his letter of 1914 to Chris Sinsabaugh (Note 45, above) says that the racers when finished would not perform, and that eventually Cooper had to buy out Ford and then get the two cars overhauled. The letter conflicts with other evidence, and does not seem to be credible.

77. Detroit *Journal*, Sept. 13, 1902.

78. Simonds, *op. cit.*, 75. Simonds erroneously dates the race October 23.

79. *My Life and Work*, 51.

80. "Detroit Races Thrill Thousands of Visitors," *Automobile and Motor Review*, VII, Nov. 1, 1902, 9–12.

81. For the 5:20 record, see Detroit *Journal*, Dec. 1, 1902, on which day the mile record was also made The *Evening News*, Sept. 10, 1902, reports the 5:15–2/5 time.

82 Detroit *Journal*, Oct. 27, 1902.

83. Simonds, *op. cit.*, 76.

84. Accession 102, Box 1, Ford Archives.

CHAPTER XI

The Ford Motor Company (*Pages 220-251*)

1. *Harper's Weekly*, Aug. 2, 1902.

2. *Ibid.*, Aug. 12, 1902. The Locomobile advertised in *Harper's Weekly for* Nov. 19, 1902, models from $2800 to $7500. The Detroit *Journal*, Feb. 15, 1904, shows that the Winton fi[illegible]-seater sold for $2500 and the Packard for $3000.

3. Detroit *News-Tribune*, Feb. 8, 1903.

4. Detroit *Free Press*, May 19, 1903.

5. *Ibid.*, Aug. 23, 1903.

6. See "*Motor's* Historical Table," *Motor*, March, 1909; and *Motor Age*, V, Sept. 12 and 19, 1899.

7. Detroit *Free Press*, May 8, 1904.

8. See estimate of E. E. Schwarzkoff, of New York, Detroit *Free Press*, Jan. 31, 1904; the Detroit *Evening News*, Jan. 5, 1905, says Detroit alone then made "nearly half."

9. Description in Detroit *News-Tribune*, Aug. 2, 1902.

10. May 8, 1904, story headed "Largest in the World."

11. Detroit *Journal*, Oct. 27, 1902.

12. So states Harry M. Jewett in an interview of Dec. 3, 1926; MS., Accession 96, Ford Archives. This is one of a large number of interviews taken by the petitioners in the case of the Estate of John F. Dodge, Estate of Horace E. Dodge, James Couzens, *et al.*, *vs.* Commissioner of Internal Revenue, before the U. S. Board of Tax Appeals, Detroit and Washington, 1927; hereafter this suit [illegible] referred to as Additional Tax Case.

MS.; Detroit *Free Press*, April 1, 1903.

Wills and Bella Roberts.

16. I have received full information on Wills from his son, Harold Wills, Jr., and from his former secretary.

17. Fair Lane Papers, Box 191. C. H. Bennett and John Wandersee, *Reminiscences*, both in Ford Archives.

18. Selected Documents, Box 1, Ford Archives.

19. Barthel, *Reminiscences*.

20. Detroit *Journal*, May 28, 1904.

21. Unnamed informant to C. C. Parlin, Memorandum in Additional Tax Case MSS., Accession 96, Ford Archives.

22. Simonds, *op. cit.*, 79.

23. John W. Anderson, Detroit, to his father, June 4, 1903; Ford Archives.

24. Wandersee, *Reminiscences*, gives the date.

25 Detroit *Free Press*, Sept. 1, 1901.

26. Contract, Secretary's Office, Ford Motor Company.

27. W. Griffiths, *Reminiscences*, Ford Archives.

28. C. H. Bennett, *Reminiscences*.

29. Detroit *Evening News*, June 19, 1903.

30. C. H. Holley, MS. Autobiography, illustrated by photographs, Ford Archives. The exact date of this meeting seems impossible to fix; Holley is emphatic that it was in the spring of 1903, but Fred Rockelman's *Reminiscences* state 1904.

31. Harry M. Jewett's statement as cited in Note 12 above; *"Motor's* Historical Table."

32. *Motor*, March, 1909.

33. Bennett, *Reminiscences*. The Daisy rifle was then made by Plymouth Iron Windmill Company.

34. Be [illegible]

35 Be [illegible] [illegible], *Money, and Motors*, [illegible]

36. Bennett, *Reminiscences*.

37. Wandersee, *Reminiscences*.

38. Anderson to his father, as cited in Note 23 above.

39. MacManus and Beasley, *op. cit.*, 28.

40. Minute Book, Ford Motor Company, Accession 85, Ford Archives.

41. Report in Additional Tax Case MSS., Accession 96, Ford Archives.

42. Merle Crowell, article in *American Magazine*, Feb., 1938, approved by Horace H Rackham.

43. The meeting was held at Malcomson's office, 149 Griswold Street; Records, Secretary's Office, Ford Motor Company.

44. Wandersee, *Reminiscences*.

45. The checkbook is in the Ford Archives; cf. Fred Rockelman, *Reminiscences*, for these days of strain.

46 Barthel in his *Reminiscences* asserts it was a copy of a car he had designed in 1901–02; but this is an unprovable and exceedingly dubious claim.

47. *My Life and Work*, 53–54; the Detroit *Journal* in Aug., 1899, published an article describing Ford's philosophy of lightness.

48 Simonds, *op. cit.*, 89; David L. Cohn, *Combustion on Wheels*, Boston, 1944, 105; *My Life and Work*, 55 ff.; Fred Rockelman, *Reminiscences*.

49. *My Life and Work*, 54–55.

50. Minute [illegible] Ford Archives; [illegible] amed hereafter cited [illegible] by the stockh[illegible]

51. Directors' Minutes, June 30, 1903.

52 Directors' Minutes, Nov. 13.

53. Secretary's Report, Sept. 30, 1903, Accession 140, Ford Archives; cf. Simonds, *op. cit.*, 88–89.

54. C. H. Bennett, *Reminiscences*.

55 Directors' Minutes, Nov. 13, 1903; the material on Couzens below is drawn largely from Harry Barnard, *James Couzens of Detroit*, MS

56. Barnard, *op. cit.*, 42; italics mine.

57. Frank Bennett, Fred W. Seeman, *Reminiscences*, Ford Archives.

58. Simonds, *op cit.*, 92.

59. Barnard, *op. cit.*, 44–45.

60. Couzens to J. W. Anderson, Oct. 1, 1903; Ford Archives

61. Couzens to the Directors, May 12, 1904, Fair Lane Papers, Box 116, Ford Archives.

62. Secretary's Report, note 53 above. Henry Ford, in *My Life and Work*, 54, gives 1708, and the Ford Motor Company has always used this figure. However, the report is authoritative.

63. Fred Rockelman, *Reminiscences*.

64. The first advertisement appeared in *Harper's Weekly*, June 20, 1903.

65. Detroit *Journal*, June 19, 1903.

66. George T. Stamm, Los Angeles Automobile Company, to Henry Ford, Sept. 14, 1904, Ford Archives.

67. Rockelman, *Reminiscences*.

68. G. T. Stamm to Henry Ford, June 29, 1904, Ford Archives.

69. See various letters of complaint, Ford Archives.

70. Rockelman, *Reminiscences*.

71. Undated Sheet of Recommendations from the Los Angeles Automobile Co., Fair Lane Papers, Box 121.

72. G. T. Stamm to Henry Ford, Sept. 14, 1904.

73. Relayed by John R. Markle, Chicago, to Henry Ford, Feb. 29, 1904, Ford Archives.

74. Rockelman, *Reminiscences*.

75. Directors' Minutes.

76. Rockelman, *Reminiscences;* no clear date is given.

77. Business correspondence, Ford Motor Company, Ford Archives.

78. Detroit *Free Press*, March 27, 1903.

79. Directors' Minutes; Detroit *Free Press*, Oct. 16, 1903.

80. J. W. Anderson MSS, Accession 71, Ford Archives.

81. Couzens to the Directors, May 12, 1904, as cited in Note 61 above.

82. Directors' Minutes, Sept. 18, 1903.

CHAPTER XII

A Battle for the Cheap Car (*Pages 252–283*)

1. National Bureau of Economic Research, *Recent Economic Changes in the United States*, New York, 1929, I, 81 ff.

2. Detroit *Journal*, Jan. 27, 1904.

3. Feb. 16, 1904.

4. Simonds, *Henry Ford*, 94–95.

5. Detroit *Journal*, Feb. 11, 1904.

6. *Ibid.*, Jan. 4, 24, Feb. 27, 1905.

7. Charles H. Dale in Detroit *Journal*, Jan. 4, 1905.

8. Sept. 8, 1905.

9 Detroit *Journal*, Jan. 2, 1905.

10. *Ibid.*, May 30, 1905.

11. *Ibid*, Feb. 11, 1904.

12. Detroit *Free Press*, Nov. 25, 1903, on purchase of building.

13. *Ibid.*, Dec. 11, 1905.

14. See the *Free Press*, July 23, 1903, for Pontiac Axle Company, Pontiac Body Company, Pontiac Wheel Company, and others.

15. Detroit *Journal*, Jan. 9, 1905.

16. Detroit *Evening News*, Oct. 28, 1903.

17. Col. Albert A. Pope, "Automobiles and Good Roads," *Munsey's Magazine*, XXII, May, 1903, 168.

18. Otto Dorner, "Good Roads and State Aid," *Forum*, XXVI, Feb., 1899, 669.

19. *Ibid.*; also W. Stull Holt, *The Bureau of Public Roads: Its History, Activities and Organization*, Institute for Government Research. Service Monographs of the United States Government. No. 26. Baltimore, 1923.

20. Holt, *op. cit.*

21. John Gilmer Speed, "Road Legislation," *Harper's Weekly*, XXXVII, July 29, 1893, 728.

22. Dorner, *op. cit.*, 669. Dorner cites the Office of Road Inquiry.

23. *Highways in Our National Life: A Symposium*, edited by Jean Labatut and Wheaton J. Lane, Princeton, 1950: "The Highway from the Railroad to the Automobile," by Albert C. Rose, 83.

24. Thomas R. Agg and John E. Brindley, *Highway Administration and Finance*, New York and London, 1927, 38. Also, Harry W. Perry, "What the Good Roads Movement Means to the Middle West," *Midland Monthly*, VII, June, 1897, 528.

25 Maurice O. Eldridge (Chief of Records, Office of Public Roads), *Public-Road Mileage, Revenues, and Expenditures in the United States in 1904*. U. S. Department of Agriculture, Office of Public Roads, Bulletin No. 32, Washington, 1907.

[illegible]

28. Frank Bennett, *Reminiscences;* Simonds, *op. cit.*, 93–94; Directors' Minutes, Jan., 1904

29 *My Life and Work*, 57–58.

30. Records, Secretary's Office; see Appendix IV.

31. Additional Tax Case. Couzens's testimony, and that of many others, is available in Accession 84, Ford Archives.

32. Charles Coolidge Parlin and Henry Sherwood Youker, *Report on Gasoline Cars*, MS., Curtis Publishing Company, Division of Commercial Research, 1913; copy in Ford Archives.

33. Stockholders' Minutes, April 1, 1904.

34. *Ibid.*, Sept. 17, 1903.

35. Detroit *Journal*, May 18, 1905.

36. Fred Rockelman, *Reminiscences*.

37. Directors' Minutes, Nov. 1, 10, 1904.

38. Detroit *News-Tribune*, Oct. 28, 1906.

39. Directors' Minutes, Sept. 9, 1905.

40 Detroit *Free Press*, May 29, 1904. For the smaller buildings, see *Twenty-third Annual Report*, Michigan Bureau of Labor and Industrial Statistics, Lansing, 1906.

41. Simonds, *op. cit.*, 101.

42. Frank Bennett, *Reminiscences*.

43. John Wandersee's *Reminiscences* contain material on the early methods of assembling cars.

44 Interview, July 26, 1926; Additional Tax Case MSS., Accession 84, Ford Archives.

45. Wandersee, *Reminiscences*.

46. Detroit *News*, Sept. 16, 1941 (interview).

47. Rockelman, *Reminiscences*.

48. Simonds, *op. cit.*, 102.

49. Article on labor, Detroit *News-Tribune*, Sept. 30, 1906.

50. *Ibid.*

51. Jacob Nathan, *Detroit Saturday Night*, Dec. 6, 1913

52. *Ibid.*

53. Henry Barnard, *Armsmear: the Home, the Arm, and the Armory of Samuel Colt*, New York, 1866, 371.

54. These estimates made by Rockelman, Wandersee, and others, are perhaps exaggerated.

55. George Brown, *Reminiscences*, Ford Archives.

56. *Ibid.*

57. T. A. Mallon, *Reminiscences*, Ford Archives.

58. Directors' Minutes, Sept. 19, 26, 1904.

59 *Ibid.*, Nov. 10, 1904.

60 *Ibid.*, Aug. 22, 1904.

61. Detroit *Journal*, May 12, 1905.

62. Records, Treasurer's Office, Ford Motor Company.

63. Detroit *Journal*, April 24, 1905.

stand, that he had best go out and manufacture some motor cars and gain a reputation and prove he wasn't a fly-by-night producer before he should ask for membership in this association."

32. F. L. Smith, "Motoring Down a Quarter of a Century," *Detroit Saturday Night*, XXII, Oct. 27, 1928, Sec. 2, 2. Smith states elsewhere that he was unaware of any formal application ever having been made by the Ford Motor Company.

33. Conceivably it may have been a different meeting, but the place and the persons present are the same, and the time seems to have been, also.

34. *Men, Money, and Motors*, 56.

35. Parker is described by reporters as resembling Lowell. His daughter, Grace E. Parker, and his son, Ralzemond D. Parker, agreed, in separate correspondence with the author, that their father was five ten inches tall, of ruddy complexion, and had gray eyes.

36. Ralzemond D. Parker to the author, March, 1953.

37. Simonds, *Henry Ford*, 90.

38. *Automobile Topics*, VI, Aug. 1, 1903, 1083.

39. Accession 20, Box 1, Ford Archives. Parker in his brief before the Circuit Court, 24–25, denounced Selden's attempt (see ensuing text) to create the impression that his patent was valid, and the repetition of the statement by Day, *Motor World*, and others. Couzens in his letter—see p. 301 of this book—said that copies of Selden's interview were distributed, and attributed this act to "the Licensed Association." Actually, Day later admitted authorizing the distribution of the interview.

40. Directors' Minutes, Sept. 17, 1903. For earlier developments, see *Cycle and Automobile Trade Journal*, VIII, July 1, 1903, 17. Under the heading "To Contest the Selden Patent," the Ford Motor Company and the Marr Autocar Company of Detroit are said to have decided to oppose the A.L.A.M., and to have retained Parker & Burton as their attorneys.

41. "A Climax is Near," *Motor World*, VII, Oct. 1, 1903, 11–12.

42. Detroit *Journal*, Oct. 24, 1903.

43. *Ibid.*

44. *Automobile*, IX, Nov. 21, 1903, 550.

45. *Horseless Age*, XII, Oct. 28, 1903, 445.

46. *Automobile*, as cited in Note 44 above.

47. XII, Nov. 18, 1903, 520.

48. The dates of procedings are fixed in *Motor World*, VII, Oct. 22, 1903, for the Ford-Duerr suit; *ibid.*, VII, Nov. 12, 1903, 229 for the Ford-Gude action; *ibid.*, VII, Dec. 31, 1903, 485 for the Panhard.

49. Interview with Frederic R. Coudert, Jan. 21, 1953. The descriptions of Betts and Redding which follow are also his.

50. R. A. Parker Papers, Automotive History Collection, Detroit Public Library. In this collection there [illegible] an extensive correspondence with Benjamin.

51. The retention of "Messrs. Cardozo & Nathan as associate New York Counsel in the patent cases pending against the company" was ordered by the Ford Directors on Nov. 28, 1903, together with the use of Jesse Smith "as an expert witness." Both actions doubtless followed suggestions from Parker. Stoddard, who is also mentioned in Parker's letters, evidently was with Parker & Burton throughout the trial.

52. Selden Case Record, I, 93–121.

53. Selden Case Record, IX, 425–605; see particularly J. F. Fawcett, 469.

54. *Ibid.*, XIII, XIV.

55. *Ibid.*, VI, 2888.

56. *Ibid.*, VI, 3117.

57. Selden Patent Case, R. A. Parker's Brief, Circuit Court, 32–33.

58. Selden Case Record, III, 757.

59. *Ibid.*, [illegible]19–1120. The "by" in Parker's sentence should be omitted. It appears in the original, but the total sentence is bad as a result.

60. *Ibid.*, 860–938.

61. *Ibid.*, IV, 1464–1466, Clerk's opening testimony.

62. R. A. Parker Papers, clipping marked "N. Y. *Sunday American*, Feb. 24, 1907" in writ-

ing; p. 25 of scrapbook. For Clerk's comment on Lenoir's engine, its alleged inability to propel a carriage, and its effect on Selden's patent could it be proved to have done so, see Selden Case Record, IV, 1664–1665. Clerk conceded that had Lenoir's engine functioned in a carriage, "then it *might* have been desirable to discuss the question of patentability"—i.e., the validity of Selden's patent.

63. Selden Case Record, III, 1323.

64. *Ibid.*, 1253.

65. *Ibid.*, VI, 2898.

66. *Ibid.*, 2878.

67. *Ibid.*, 2967.

68. Selden Patent Case, R. A. Parker's Brief, Circuit Court, 35.

69. Parker to Henry Ford, Dec. 24, 1906, Henry Ford Office Files, Ford Archives.

70. Wandersee, *Reminiscences*, 12. Allison is mentioned by Carpenter as being in charge of the machine when it was demonstrated. C. J. Smith, *Reminiscences*, 15, Ford Archives.

71. Selden Case Record, XII, 2453–2473—Carpenter's statement. Carpenter said that the ignition followed Lenoir's American patent of 1861 (p. 2489).

72. *Ibid.*, 2473–2474.

73. *Ibid.*, XI, 1885; XII, 2421 ff.

74. *Ibid.*, XI, 2269.

75. Henry Cave, "Cave Cites Years in Developing Car," *Old Timers News*, III, No. 1, April, 1945, 11 ff. Hiram Percy Maxim also refers to Cave's work in constructing Exhibit 157 in his *Horseless Carriage Days*, 172. Exhibit 89 was of course constructed in Rochester.

76. Parker's brief, Circuit Court, 61, admirably sums up the differences between the Selden "buggy" (157) and the "teaching of the patent." See note (*) on p. 315 for his remarks.

77. Selden Patent Case, Parker's Brief, Circuit Court, 51–52.

78. John C. Wetmore, "Ford Attacks the Selden Car Trial," New York *Evening Mail*, June 25, 1907.

79. Selden Case Record, XI, 1997–1998. Carpenter's testimony about the car runs from 2461 to 2683.

80. *Ibid.*, XII, 2681–2682.

81. Selden Patent Case, Brief of Complainant-Appellees (Redding), Circuit Court, 213–214.

82. Interview cited in Note 49 above.

83. Henry Ford Office Files, Ford Archives. The ensuing letters are noted by date.

84. *Horseless Age*, VII, Dec. 5, 1900, 26.

85. *Ibid.*, XII, Oct. 7, 1903, 386.

86. *Motor World*, V, Feb. 5, 1903, 662.

87. *Cycle and Automobile Trade Journal*, VII, Nov. 1, 1903, 18–19, for advertisement by this association.

88. Detroit *Journal*, Feb. 25, 1905.

89. Henry Ford Office Files, Accession 2, Box 30, Ford Archives. Henry Ford's appointment is reported in a letter to him from Reeves on May 3, 1909. For Reeves, see Detroit *News-Tribune*, June 17, 1906. He established offices in the Spalding Building, 31 East 42nd Street, New York.

90. *Automobile*, XVI, May 2, 1907, 735–736.

91. R. A. Parker Papers.

92. XX, July 10, 1907, 44.

93. *Cycle and Automobile Trade Journal*, IX, Oct. 1, 1904, 200.

94. *Motor World*, XVII, Dec. 12, 1907, 568. The E.V.C. went into receivership on December 10, 1907.

95. *Ibid.*, XVIII, May 7, 1908, 173.

96. *Ibid.*, XX, June 17, 1909, 447.

97. *Automobile*, XVI, May 2, 1907, 735–736.

98. *Ibid.*, 736.

99. Selden Case Record, VI, 3102. "I may add that personally I am on good terms with Mr. Ford, and that I rather admire the business skill with which he has managed his enterprise."

100. *Motor World*, XIII, Aug. 9, 1906, 439.

CHAPTER XIV

Forerunner: Model N (*Pages 323–353*)

1. "The Passing of 'The Game,'" *Motor World*, XVII, Oct. 24, 1907, 173.
2. "Assembling: Its Relations to Success and to Failure," *ibid.*, 185–187.
3. Hugh Dolnar, "The Ford 4-Cylinder Runabout," *Cycle and Automobile Trade Journal*, XI, Aug. 1, 1906, 108–116.
4. *Ibid.*, 115–116.
5. Fred Seeman, *Reminiscences*, Ford Archives.
6. Max F. Wollering, Frank Bennett, and Charles E. Sorensen, *Reminiscences*, Ford Archives.
7. Barthel, *Reminiscences.*
8. Wollering and C. J. Smith, *Reminiscences.*
9. Early volumes of the *Ford Times*, beginning in 1908, contain much material on the success of Model N.
10. Records, Treasurer's Office, Ford Motor Company; see Appendix III.
11. Simonds, *Henry Ford*, 105; Directors' Minutes; Ford-Couzens Agreement.
12. Fred Rockelman, *Reminiscences.*
13. Records, Secretary's Office, Ford Motor Company.
14. Charles H. Bennett, *Reminiscences;* he says "sold," but this is dubious.
15. Simonds, *op. cit.*, 105–106.
16. Directors' Minutes, July 14, Aug. 24, Sept. 7, 1906.
17. Rockelman, *Reminiscences.*
18. C. C. Parlin and H. S. Youker, *Report on Gasoline Cars*, MS., 1913.
19. *Ibid.*
20. *Ford Times*, IV, June 16, 1911, gives a complete description.
21. Parlin and Youker, *op. cit.*, makes much of this.
22. Flanders [illegible] Couzens, Cleveland, July 19, 1906, Ford Archives. It may be noted that Keith Sward, in *The Legend of Henry Ford*, p. 32, errs by more than two years in placing Flanders's arrival late in 1908.
23. Couzens [illegible] Ford, July 24, 1906, Ford Archives.
24. Charles E. Sorensen, *Reminiscences.*
25. This memorandum is now in the Ford Archives.
26. *Ibid.*
27. Directors' Minutes, Jan. 6, Oct. 22, 1906.
28. Detroit *Journal*, Jan. 5 ,1906.
29. Directors' Minutes, Sept. 7, 1906; this contains a full account of sales policy.
30. *Ibid.*
31. *Ford Times*, IV, June, 1911, 262–263.
32. Records in Secretary's Office, Ford Motor Company.
33. Directors' Minutes, Nov. 26, 1906. Folded into the minute book is a letter of Couzens to Henry Ford dated Nov. 24, 1906, showing that he had brought a good deal of pressure to bear for a higher salary. He declared that even the new salary arrangement would not bring his compensation up to that of men in comparable positions, and asked for a quick decision "as [illegible] the past few months."

[illegible] Tax Case MSS., Ford Archives.

[illegible] 1, 1907.

[illegible] Minutes, April 27, July 5, 1907; Accession

38. *Ibid.*, Dec. 12, 1906.
39. Norval A. Hawkins, Inventory of Ford Manufacturing Company, May, 1907; Ford Archives.
40. Directors' Minutes, Oct. 22, 1906.

41. See advertisement, Detroit *News-Tribune*, Oct. 27, 1907, for Hawkins's business; Detroit *News*, Nov. 25, 1907, for his appointment as investigator.

42. Testimony by Lacey, Additional Tax Case MSS., Accession 84, Ford Archives.

43 George Brown, *Reminiscences*, Ford Archives.

44. Additional Tax Case, *Transcript of Hearings*, 1540–1541.

45. *Ibid.*, 1555.

46. *Ibid.*

47. Parlin and Youker, *op. cit.*

48. Additional Tax Case, *In Re: Valuation of Ford Motor Company Stock as of March 1st, 1913*, 183 (copy), Accession 84, Box 2, Ford Archives.

49. *Motor World*, XXXIII, Dec. 12, 1912, 20.

50. Directors' Minutes, Sept. 7, 1906, cover the meeting of that year.

51. Additional Tax Case, *Transcript of Hearings*, 1547–1558.

52. Mrs. Leroy Pelletier credits the slogan to her husband.

53. Sept. 1, 1908.

54. This letter is in Henry Ford's personal file, Accession 1, Ford Archives.

55. Detroit *Journal*, Aug. 26, 28, 1905.

56. *Ibid.*, Jan. 22, 24, 27, 1906.

57. Detroit *News*, Oct. 17, 1900.

58. *My Life and Work*, 66.

59. *Ibid.*

60. Detroit *Journal*, March 21, 1907.

61. The Ford Archives contain a photograph of Henry Ford and J. Kent-Smith watching vanadium steel being poured at Canton, Ohio. The company published an advertising brochure on Model R in 1907 (copy in Ford Archives) which describes its early dependence on nickel chrome, and the adoption of vanadium.

62. Wandersee, *Reminiscences*.

63. *Ford Times*, V, March, 1912, 184–185.

64. Advertisement, *Harper's Weekly*, May 4, 1907.

65. W. E. Scarritt, "The Horse of the Future," *Harper's Weekly*, March 16, 1907.

66. *Motor World*, XVII, Oct. 17, 1907, 105, 106, 112.

CHAPTER XV

New Growths, New Problems (*Pages 354–386*)

1. New York *World*, Aug. 21, 1907.

2. Additional Tax Case, Accession 84, Box 1, Ford Archives.

3. Benjamin Briscoe, "The Inside Story of General Motors," *Detroit Saturday Night*, XV, Jan. 15, 1921, Section 2, 2–9. Also Pound, *The Turning Wheel*, 75–76.

4. Detroit *News*, Aug. 22, 1907.

5. *Automobile*, XVII, Dec. 26, 1907, 963.

6. George Brown, *Reminiscences*.

7. MacManus and Beasley, *Men, Money, and Motors*, 74–84.

8. Dodge Brothers Suit, Auditing Records, Accession 33, Box 41, Ford Archives.

9. Stockholders' Minutes, Oct. 22, Directors' Minutes, No. 3, 1908.

10. Detroit *Journal*, Sept. 1, 1910.

11. Lord Perry, *Reminiscences*, corrected by St. John-Stevas; Archives of Ford Motor Company of England, Ltd.

12. *Ibid.*

13. Interview of author with Lord Perry, March 28, 1952.

14. *Ford Times*, March 1, 1910.

15. At 6 bis, Rue Auber, Paris.

16. *Ford Times*, June, 1910.

17. H. B. Harper's article is in the *Ford Times*, July 15, 1908. For the position of the auto-

mobile industry regarding the tariff, see *Automobile*, XIX, Dec. 17, 1908, 863–864. European cars in general represented more hand work than American cars. Their sales naturally declined as the machine production of American factories became more dependable, and as American prices fell. As early as 1906, this slackening of foreign importations was visible. But large quantities of some parts, notably pneumatic tires, ignition appliances, and ball bearings, were still brought from abroad. See "Our Foreign Commerce in Automobiles and Parts," *Horseless Age*, XVIII, Sept. 12, 1906, 320–321.

18 *Motor World*, XVII, March 12, 1908, 989.

19. These names and titles are in *Ford Times*, June 15, 1908.

20. Theodore A. Mallon, *Reminiscences*.

21. [illegible]

22. [illegible]" *Iron Age*, LXXI, March 12, 1903, 10–11.

23. [illegible]n *Machinist*, XXXVIII, Jan. 23, 1916, 161.

24. [illegible]eth Century," *Munsey's Magazine*, XLIII, Aug. 1910, 601.

25. Frank Bennett, *Reminiscences*.

26. Joseph Galamb, *Reminiscences*.

27. Leslie M. Robertson, "Auto Making," Detroit *News-Tribune*, Dec. 29, 1907.

28. Detroit *News-Tribune*, Feb. 10, 1907.

29. C. B. Hayward, "How Detroit Will Build 50,000 Autos in 1909," *Automobile*, XIX, Dec. 17, 1908, 867–868.

30. Simonds, *Henry Ford*, 113.

31. Detroit *Journal*, Feb. 16, 1909.

32. Louis C. Scott (*Reminiscences*, Ford Archives), who had married Clara's cousin Nettie Bryant, says that the site was the old Voigt farm, and tells how Ford took him through the unfinished house. In Fair Lane Papers (Accession 1), Box 177 (Henry Ford—Residences) there is much information in the form of bills and memoranda about the rooms of the house, its interior decorating, the landscaping of the grounds, and so forth.

33. Fair Lane Papers, Box 19 (Clara Bryant Ford), contains a letter from the Anderson Carriage Company of Detroit to Clara, Jan. 21, 1910, which informs her that she purchased her car on July 16, 1908, that it had run 4800 miles, and had cost only $14.20 for general repairs, $109.65 for "tire expense," and $90 for battery expense. This excellent record was doubtless made possible by the care Louis Scott gave the vehicle. He tells about this aspect of his work in his reminiscences, cited above.

34. George Brown, *Reminiscences*.

35. Simonds, *op. cit.*, 110–112, tells about the early airplane experiments, and Brown mentions them. Miss Catherine Ruddiman's association with Edsel is covered in her mother's reminiscences.

36. *Detroit Saturday Night*, II, March 14, 1908, 7; Detroit *News*, March 14, 1908.

37. Detroit *News*, March 14, 1908.

38. "Statistics of the Automobile Industry," *Horseless Age*, XXI, March 25, 1908, 359.

39. Records of the Secretary's Office, Ford Motor Company.

40. L. E. Tossey, "History of the Council of Trades and Labor Unions, Review and Record of the Past Year," in *Detroit Council of Trades and Labor Unions, Annual Labor Day Souvenir*, 1896, 7–9.

41. See *Annual Reports* of the Michigan Bureau of Labor and Industrial Statistics, Lansing, [illegible] on of Detroit, 1904, 28–31.

[illegible]

[illegible]

44. Quoted in *The Emancipator*, July 15, 1911 (socialist weekly).

45. See *Michigan Union Advocate*, Feb. 10, 1905, for an example.

46. May 3, 1909.

47. See *Twenty-third Annual Report*, Michigan Bureau of Labor and Industrial Statistics, Lansing, 1906, 365.

48. *Twenty-third* to *Twenty-sixth Annual Reports*, inclusive, Michigan Bureau of Labor and Industrial Statistics; *First Annual Report*, Michigan Department of Labor, 1910.

49. Paul H. Douglas, *Real Wages in the United States*, Boston, 1930, 130.
50. Paul F. Brissenden, *Earnings of Factory Workers, 1899–1927*, Washington, 1929, 152, 186.
51. *First Annual Report*, Michigan Department of Labor, 1910.
52. November 10, 1911.
53. *Michigan Union Advocate*, Sept. 7, 1906.
54. Report, Aug. 5, 1906; Henry Ford Office Files, Accession 2, Box 37, Ford Archives.
55. Report, Aug. 7, 1906.
56. Report, Aug 5, 1906.
57. Report, July 21, 1906.
58. Parlin and Youker, *Report on Gasoline Cars*, MS., 393–394.
59. See *Horseless Age*, XXIII, March 3, 1909, 299–300.
60. XXIII, Jan. 6, 1909, 29–30.
61. XXI, Jan. 22, 1908, 87.
62. "Bond Houses Now in Open Enmity," *Motor World*, XXIV, July 7, 1910, 26.
63. *Nation*, LXXXVIII, Jan. 7, 1909, 7–8.

CHAPTER XVI

The Advent of Model T (*Pages 387–414*)

1. All letters dated March 21, 1908; *Ford Times*, I, April 15, 1908, 14–15.
2. For a full description, see *Ford Times*, July 1, 1908, a model is in the Edison Museum at Dearborn, Michigan.
3. Charles E. Sorensen, *Reminiscences*. Joseph Galamb, in a statement made for the Additional Tax Case (Accession 84, Ford Archives), tells of the Renault and Minerva.
4. Joseph Galamb, *Reminiscences*.
5. C. J. Smith, *Reminiscences*, Ford Archives.
6. Holley, Illustrated Autobiography, MS., Ford Archives.
7. *Ibid.*
8. Rockelman, *Reminiscences*.
9. *Ibid.*
10. Additional Tax Case, *Petitioners' Statement of Facts*, 51, 52.
11. Joseph Galamb's statement in Additional Tax Case MSS., Ford Archives.
12. *Ibid.*
13. Holley, *op. cit.*
14. C. J. Smith, John Wandersee, Fred Rockelman, Theodore Mallon, Joseph Galamb, and George Holley all give their impressions.
15. George Brown, *Reminiscences*.
16. Alexander, J. M. Gray, *World's Work* (London), Jan., 1910, cited in *Ford Times*, III, Feb 1, 1910, 187.
17. Floyd Clymer, *Treasury of Early American Automobiles*, New York, 1950, 68, 75.
18. C. J. Smith, *Reminiscences*.
19. Cf. Albert Blumenstiel, New York, to Henry Ford, Sept. 29, 1910; Henry Ford Office Files, Ford Archives.
20. *Ford Times*, VI, Oct., 1912, 27.
21. *Ibid.*, VI, Jan., 1913, 169.
22. *Ibid.*, II, June 1, 1909, 10.
23. Parts of Lee Strout White's *Farewell to Model T*, "a sigh that is not a sob," have been frequently reprinted; as in David L. Cohn, *Combustion on Wheels*, 144–146.
24. Theodore A. Mallon, *Reminiscences*.
25. Detroit *News*, Sept. 16, 1908.
26. *Ford Times*, II, May 1, 1909, 1.
27. *Ibid.*, IV, June, 1911, 265.
28. The exact figure is $9,041,290.55.
29. Records, Secretary's Office, Ford Motor Company.

30. *Ford Times*, III, Dec. 15, 1909, 100.
31. *Ibid.*, II, March 15, 1909, 10.
32. Fred Rockelman, *Reminiscences*.
33. Sloan, *Adventures of a White-Collar Man*, 45.
34. *Ibid.*, 74
35. Alfred Lief, *The Firestone Story*, New York, 1951, 26.
36. *India Rubber World*, March, 1906, cited in Lief, *op. cit.*, 28.
37. Lief, *op. cit.*, 28.
38. *Ford Times*, 1, July 1, 1908, 8-9.
39. George Brown, *Reminiscences*.
40. *Ford Times*, II, Oct. 15, 1908, 10.
41. *Ibid.*, Aug. 15, 1909, 4.
42. Cf. the authority delegated at the Directors' meeting, July 26, 1916.
43. Additional Tax Case, *Petitioners' Statement of Facts*, 79.
44. *Ibid.*, 82.
45. See *Ford Times*, V, April-May, 1912, 209.
46. Additional Tax Case, *Petitioners' Statement of Facts*, 80.
47. Detroit *Journal*, Aug. 20, 1909.
48. *Ford Times*, IV, July, 1911, 300–302.
49 Interview with C. J. Smith in *Ford Times*, March, 1951, 12.
50. *Detroit Saturday Night*, III, Nov. 27, 1909; *Automobile*, XXI, July 1, 1909.
51. *Ford Times*, III, Oct. 15, 1909, 21.
52. Directors' Minutes, July 28, 1909; *Ford Times*, II, No. 22.
53. Additional Tax Case MSS, Accession 84, Box 1, Ford Archives.
54. Directors' Minutes, May 1, 1912.
55. Detroit *Journal*, June 6, 1912.
56. Directors' Minutes, June 3, 1913.
57. Floyd Clymer, *op. cit.*, 90.
58. Detroit *Journal*, July 9, 1909.
59. July 9, 1909.
60. Records, Secretary's Office, Ford Motor Company.
61. David L. Cohn, *op. cit.*, 94.
62. *Detroit Saturday Night*, Jan. 22, 1910; to be exact, $7,865,000.
63. MacManus and Beasley, *Men, Money, and Motors*, 240–241, 247–248.
64. Pound, *The Turning Wheel*, says 12.5; MacManus and Beasley, *op. cit.*, says 10.
65. *Ibid.*, 114–121.
66. *Ibid.*, 123.
67. *Ibid.*, 120–121.
68. *Ibid.*, 127–130.

CHAPTER XVII

No Monopoly (*Pages 415–446*)

1. Fair Lane Papers, Box 142, Ford Archives.
2. Selden Patent Case, Brief of R. A. Parker, Circuit Court, 28.
3. *Motor World*, XX, June 10, 1909, 405. Apparently this paper had a representative present through the hearings which closed on June 4, although its account might have been taken from the record.
4. The New York *Sun*, June 2, 1909, notes Ford's presence in New York and other facts which will appear show that he attended the trial. His interest in it was intense.
5. *Dictionary of American Biography*, XIII, 591.
6. [illegible] Circuit Court, 10.

[illegible] urt, 10.

[illegible] *in* was then a morning paper.

[illegible] unusual happening. During the

1920's (perhaps 1921 or 1922, prior to the issue of Ford's and Crowther's *My Life and Work*), his telephone rang one night. "I am Henry Ford," said a voice when he took down the receiver. "What kind of joke is this?" demanded Coudert, who had not seen Ford for years and was highly suspicious of this sudden materialization by telephone. "This is Henry Ford," insisted the voice calmly, "and I have come to New York to see you about the Selden Patent Case." "Why, that's over and done with years ago." "I know it. I want to see you about it, and I'll be in your office at 3 o'clock tomorrow, if that's convenient for you." "All right," answered Coudert, "I'll be there." Ford appeared, and explained that he was writing his autobiography. He wanted [illegible] verify the episode of the race, and particularly to confirm his impression that Coudert was the one who had remarked on the absence of the Selden car. (Interview with F. R. Coudert, Jan. 21, 1953.) Ford does not refer to the incident in *My Life and Work*.

10. Interview with Coudert as cited above.

11. Selden Patent Case, *Brief of Complainants*, Circuit Court, 132.

12 *Ibid.*, 160, 164. As to alterations in the patent, the Selden counsel conceded that these had been made, but argued that they were implicit in Selden's original claims. They also asserted that Selden had early made his invention known to "a large portion of the public." They cited Selden's own testimony as to his efforts to find a backer. "A large portion of the public" would thus comprise his family, a few intimate friends, and prospective investors—almost all residing in Rochester, New York.

13 Judge Hough's opinion is usually incorporated with bound volumes of the Selden Patent Case Record. However, the official text appears in 172 Fed. Rep. 923 (1909).

14 *Horseless Carriage Days*, 172.

15. F. L. Smith, "Motoring down a Quarter Century," *Detroit Saturday Night*, XII, Oct. 27, 1928, Sec. 2, 2.

16. Detroit *News-Tribune*, Sept 26, 1909.

17 On Sept. 16, 1909. Fair Lane Papers, Box 142, Ford Archives.

18. Detroit *Journal*, Sept. 16, 1909.

19. *Ibid*, Feb. 12, 1910.

20. "We were never afraid of the outcome," said Couzens in Jan, 1911. Detroit *Journal*, Jan. 10, 1911.

21. W. J. Cameron, "Liberating an Industry," in *A Series of Talks Given on the Ford Sunday Evening Hour, 1934–35*, Dearborn, 1935, 52.

22 Memorandum of Conference in Connection with the Dodge Tax Matter, Ford Archives, interview of Anderson by Arthur J. Lacey, 272–273.

23. Henry Ford Office Correspondence, Accession 2, Box 31, Ford Archives.

24. Detroit *Journal*, Jan. 10, 1911. "With the exception of briefs prepared by Wetmore & Gifford, of New York, and Patent Attorney Offield, of Chicago, the handling of the case in and out of court has been entirely by Mr. Parker." This is not conclusive, and omits reference to Parker's making no appearance at the oral arguments. However, both Grace E. Parker and her brother Ralzemond D. Parker wrote the author in March, 1953, that they had always thought their father remained in charge of the case, and their statements make it pretty certain that he did.

25. Interview of Jan. 21, 1953.

26. *Motor World*, XX, May 13, 1909, 241–242. The Olds license was cancelled Sept. 3, 1908, and suit against Buick was started in October. (*Motor World*, Sept 24 and Oct 22.) Apparently Durant then paid his Buick fees. Neither car was exhibited [illegible] the licensed Show that year, and the independents would not receive them. (*Motor World*, Oct. 29, 1908.)

27. Detroit *News*, Oct. 19, 1909, for the entire General Motors story.

28. *Ibid.*, Sept. 22, 1909.

29 Detroit *Journal*, Jan. 5, 1910.

30. *Detroit Saturday Night*, III, Feb. 12, 1910, 5.

31. *Ford Times*, III, Nov. 1, 1909, 42–43.

32. Detroit *News*, Aug. 24, 1910. The bond was for $350,000, although in July (*Detroit Saturday Night*, IV, July 30, 1910, 5) the complainants after asking for the decree suggested $500,000.

33 Detroit *News*, Feb. 24, 1910.

34. Detroit *Journal*, Feb. 26, 1910. Both A.L.A.M. and Ford advertisements had appeared in New York and Chicago papers earlier in the month. See *Ford Times*, III, Feb. 15, 1910, 208–209. A Chicago advertisement had appeared on the 11th.

35. *Ford Times*, III, March 15, 1910, 17.

36. Detroit *News-Tribune*, April 17, 1910.

37. According to *Automobile*, XXII, March 10, 1910, the A.L.A.M., had 76 members in March, 1910, and the *Cycle and Automobile Trade Journal* for Feb. 1, 1911, XV, 135, gave 84 as the membership at the time of the Noyes decision.

38. *Ford Times*, III, June 1, 1910, back cover.

39. Detroit *Journal*, June 4, 1910.

40. Detroit *News*, July 7, 1910.

41. *Ibid*., April 20, 1910.

42. *Motor World*, XXII, Jan. 6, 1910, 45. Selden's advertisements appeared in this pro-A.L.A.M. publication for years.

43. *Ibid*., XXV, Nov. 24, 1910, 489–490. This account specifies "the post office building." Doubtless the more than forty lawyers mentioned in this account included a number of clerks and juniors.

44. *National Encyclopaedia of American Biography*, XXIII, 25.

45. *The Cyclopaedia of American Biography*, VIII, 274.

46. *Dictionary of American Biography*, XIII, 591.

47. *Automobile*, XXIII, Nov. 24, 1910, 887; and *Motor World*, XXV, Nov. 24, 1910, 489–496.

48. For the quotations from Coudert's brief I am indebted to a typed version in his papers. The official record will be found in Docket 4058, X, Transcript of Record for the Appellate Court.

In 1953 Coudert gave a detailed account of his use of Clerk's book and its part in the case. Some weeks prior to the hearings, he recalled, he had gone to Betts's office, whether by appointment or on a sudden decision he did not recall. The two were well acquainted. In any case, Betts was engaged and sent out word that he would not be free for some minutes. The reception room was large, several other people were waiting, and Coudert strolled over to a large table on which lay a number of books and magazines. Here he noticed a set of proofs, and on glancing at them saw that they were a new edition of the English expert's book. Naturally he turned to the index to see if Clerk had anything to say about Selden or the case.

Coudert recalled that there was a mention of the patent, and that Clerk said Selden had claimed to hold a pioneer or basic patent, but in his opinion was not entitled to one of that type. Of course Coudert at once sent to the publishers for a copy of the forthcoming book, which he received just prior to the oral arguments.

Before the arguments began, but in the presence and hearing of the three judges, Coudert asked Betts and Redding if they based their case primarily on Clerk's testimony. They conferred [illegible] book if they de- [illegible] ity. Betts [illegible] nind, Mr. [illegible] what he has to say is applicable or not." After the final decision had been rendered, Coudert found occasion to ask Noyes if his use of Clerk's book had been influential. Noyes smiled and said "Well, of course we took account of it, and when Betts and his associates didn't rebut what you brought out, Clerk didn't have very much credit with us." (Interview of Jan. 21, 1953)

49. Interview cited above.

50. Noyes's opinion will be found in 184 Fed. Rep. 894 (1911).

51. Jeffery's telegram was sent Jan. 10, and its full text, with that of dozens of other messages, can be found in the *Ford Times*, IV, Feb., 1911, 175–178. For action on Jeffery's gift, see Directors' Minutes, April 21, 1911.

52. Detroit *Journal*, Jan. 11, 1911.

53. Detroit *Free Press*, Jan. 12, 1911.

54. Detroit *Journal*, Jan. 11, 1911.

55. *Automobile*, XXIV, Jan. 19, 1911, 232.

56 *Ford Times*, IV, Feb., 1911, 172–173.

57. Interview of Jan. 21, 1953. Coudert remarked that he had participated in only one other patent case, that involving the G. & J. (Goodrich) tire. The Court held that there was no pioneer tire patent involved—Coudert's contention. "I was hard on the 'pioneers,'" he said with a smile.

58. Benson, *The New Henry Ford*, 158.

59. *Ibid.*, 159–160.

60. Henry R. Selden, "Selden's Contribution to the Automobile," typescript dated Feb., 1940 (photostat). *Automotive* History Collection, Detroit Public Library

61. Undated letter to H. M. Campbell, probably written before or during the summer of 1911. R. A. Parker Papers, Automotive History Collection, Detroit Public Library.

62. Epstein, *The Automobile Industry: Its Economic and Commercial Development*, 232. Epstein gives the $5,800,000 figure. Through 1907, said *Automobile* on May 7, 1908, $1,893,608.93 had been paid. However, from 1907 on the Association grew in number of firms licensed and in value of licensees' output, and particularly after the first decision in 1909. Thus Epstein's estimate, which he states is based on A.L.A.M. records, seems a just one.

63. *Detroit Saturday Night*, V, Jan. 20, 1912, 41

64. Selden Patent Case. Opinion of Judge Charles Merrill Hough, 172 Fed. Rep. 1923 (1911) at 924–925.

65 *Scientific American*, CVI, April 6, 1912, 307.

66. R. A. Parker to Henry M. Campbell, as cited in Note 61 above.

67. In order, comments by these writers appear in "Our Defective Patent System," *Outlook*, CI, July 6, 1912; "The Abuses of Our Patent System,"*Scientific American Supplement*, LXXIII, June 1, 1912, 346–347; and "The United States Patent System," *ibid.*, June 15, 1912, 383–384.

68. Detroit *Journal*, Jan 10, 1911.

69. A. M. Smith, who assisted Margaret Ford Ruddiman to compile her memoirs, remarked in an interview of Nov. 20, 1951, that the Selden case "could easily have been a blessing in disguise from the standpoint that here was a lot of capital that had been put aside as surplus which was there for working capital right at the time when they needed working capital badly to expand their operations."

70. Additional Tax Case, *In Re: Valuation of Ford Motor Company Stock as of March 1st, 1913*. Accession 84, Box 2, Ford Archives

71. Fair Lane Papers, Box 27.

72. Fair Lane Papers, Box 93.

73. These facts are taken from the two diaries; Clara's is in Fair Lane Papers, Box 92, and Edsel's in Box 31 of the same accession.

74. Detroit *Evening News*, Nov. 22, 1913.

75. Interview with Lord Perceval Perry, March 28, 1952.

76. Barnard, *James Couzens of Detroit*, MS., 82–84, 131.

CHAPTER XVIII

A Lever to Move the World (*Pages 447–480*)

1. *The Encyclopaedia Britannica*, 11th edition (XVIII, 920), says 5000 steam and electric cars were made.

2. See advertisements of the Buick, White, and Hupp Companies in *Harper's Weekly*, Jan. 6, 1912.

3 All advertisements in *Harper's Weekly*, 1912.

4. J. J. Seaton, in *Harper's Weekly*, Jan. 1, 1910.

5. Oberlin Smith, "Modern Machine Shop Economics," *Cassier's*, XVII, Feb., 1900, 295–299.

6. Thomas J. Fay, "Distinguishing Features Found in 1910 Product," *Automobile*, XXII, Jan. 6, 1910, n.p.

7. *Ibid.*

8. *My Life and Work*, 73.

9. Directors' Minutes, July 29, 1908, Dec. 18, 1909.

10. Sorensen distinctly recalls this famous quip; *Reminiscences.*

11. Detroit *Journal,* Jan. 15, 1910; see numerous plans, photographs, in Ford Archives.

12. All gave evidence in Additional Tax Case; see *Petitioner's Statement of Facts,* 56–57.

13. *Ibid.*

14. Records, Secretary's Office.

15. Barber, *Story of the Automobile,* 104, 110–114.

16. Hawkins, 1926 Affidavit in Additional Tax Case, Accession 96, Ford Archives.

17. "Pressed Steel Automobile Parts," *Horseless Age,* XXIV, Sept. 8, 1909, 263–264.

18. E. Walters, *Reminiscences,* Ford Archives.

19. *Ibid.*

20. *Ibid.* The comment on Lee in the preceding paragraph is from his obituary notice in *Automobile Topics,* CXVI, Jan. 12, 1935, 637.

21. Walters, *Reminiscences.*

22. Stockholders' Minutes, June 22, 1911; Minute Books, as cited in Note 9 above.

23. So Knudsen reported; Walters, *Reminiscences.*

24. MacManus and Beasley, *Men, Money, and Motors,* 246.

25. E. F. Lake, "The Foundry in Its Relation to the Automobile Factory," *Horseless Age,* XVIII, Sept. 12, 1906, 327–328.

26. *Ford Times,* IV, June, 1911.

27. See *Motor World,* IX, Feb. 23, 1905; March 15, 1905.

28. Emde testimony, Additional Tax Case MSS., Accession 96, Ford Archives.

29. *Ford Times,* IV, Aug., 1911, 313–314.

30. Carl Emde testimony, as cited above.

31. Testimony, Additional Tax Case; see *Petitioners' Statement of Facts,* 150.

32. All in Additional Tax Case; see *Petitioners' Statement of Facts,* 75.

33. See his series of articles in *American Machinist,* May 8-Sept. 13, 1913.

34. Detroit *Journal,* Oct. 1, 1910.

35. William Pioch, *Reminiscences,* Ford Archives.

36. President J. R. Blakeslee of Ajax Manufacturing Company to R. H. Berry, June 23, 1926; Additional Tax Case.

37. Pioch, *Reminiscences.*

38. Greville and Dorothy Bathe, *Oliver Evans,* Philadelphia, 1935.

39. Peter Barlow, *Encyclopaedia of Arts, Manufactures, and Machinery,* London, 1851, 801–804.

40. Joseph Wickham Roe, *English and American Tool Builders,* 75–80.

41. S. Giedion, *Mechanization Takes Command,* New York, 1948, 93–97.

42. Frank Barkley Copley, *Frederick W. Taylor, Father of Scientific Management,* New York, 1923, I.

43. See *Nation,* XCII, May 11, 1911.

44. H. R. 52, Sixty-second Congress, First Session.

45. Copley, *op. cit.,* II, 445.

46. A. M. Wibel, Interview, July 23 and 29, 1926; Additional Tax Case MSS., Accession 96, Ford Archives.

47. Pioch, *Reminiscences.*

48. Bornholdt Interview, July 26, 1926; Additional Tax Case MSS., Accession 96, Ford Archives.

49. Horace Lucien Arnold and Fay Leone Faurote, *Ford Methods and the Ford Shops,* New York, 1915, 281–282.

50. Charles E. Sorensen, *Reminiscences.*

51. Arnold and Faurote, *op. cit.,* 282.

52. *My Life and Work,* 81.

53. *Ibid.*

54. *Ibid.*; Artemas L. Litigot, *Reminiscences,* Ford Archives.

55. Arnold and Faurote, *op. cit.,* 137–139.

56. *My Life and Work,* 82.

57. Arnold and Faurote, *op. cit.*, 142.
58. *Ibid.*, 141–142.
59 *My Life and Work*, 83.
60. Records, Secretary's Office.
61. Article "Mass Production," *Encyclopaedia Britannica*, 14th edition, XV, 38.
62. *Detroit Saturday Night*, Jan. 22, 1910.
63 Pound, *The Turning Wheel*, *Chaps.* 8, 9.
64 *Ibid.*, 143–166.
65. Additional Tax Case MSS., Accession 84, Box 2, Ford Stockholders' Tax Suit.
66. Directors' Minutes, Aug. 21, 1913.

CHAPTER XIX

The Anatomy of Success (*Pages 481–511*)

1. Ralph C. Epstein, *The Automobile Industry*, 105–110 Advertisement of cars in *Harper's Weekly*, Jan.-Feb., 1914, indicate many of the main trends

2. Wilson made the driver of his car keep within the 25-mile speed limit. *Horseless Age*, XXXII, Nov. 19, 1913, 860.

3. Edith Wharton, *A Backward Glance*, New York, 1924, 137, 153; Epstein, *op. cit.*, 104–105.

4. W. Stull Holt, *The Bureau of Public Roads* (as cited in Note 19, Ch. XII), 9

5. (Senator) Carl Hayden, "The History of Federal-Aid Highway Legislation," in *The History and Accomplishment of Twenty-five Years of Federal Aid for Highways*, American Association of State Highway Officials, Cincinnati, 1944, 7–8.

6. J. E. Pennybacker, Jr., and Maurice O. Eldridge, *Mileage and Cost of Public Roads in the United States*, Bulletin 41, Office of Public Roads, Washington, 1912, 7–8.

7. T. H. MacDonald, "The Financing of Highways," *Annals of the American Academy of Political Science*, CXVI, Nov., 1924, 150. MacDonald points out (p. 166) that the percentage of revenues from taxes on gasoline and vehicles to the total "highway income" was 51 per cent in 1914. Presumably it was less a year earlier.

Note 27, Ch. XII).

er, in "Traffic

ad Wheaton J.

Lane, 85.

10. *The Lincoln Highway: The Story of a Crusade That Made Transportation History*, (Auspices of Lincoln Highway Association), New York, 1935, 5–6.

11. *Highways in Our National Life*, 102–103.

12 *The Lincoln Highway*, 8.

13. *Ibid.*, 4–5. Material dealing with the Lincoln Highway in the remainder of this section is based on this work.

14. MacDonald, *op. cit.*, 150, 165.

15. The annual statistical volume of the National Chamber of Commerce, *Facts and Figures of the Automobile Industry*. The Chamber was formed in 1913. These figures are taken from the Industrial Census as of 1906, 1911, and 1916.

16. Additional Tax Case, *Petitioners' Brief and Argument*, 151.

17. *Ibid.*, 216,

18. Like all automobile statistics of the time, these figures are open to slight correction.

19. Additional Tax Case, *Petitioners' Statement of Facts*, 92, 93; these are carefully prepared estimates.

20. *Harper's Weekly*, Jan. 11, 1913, 10.

21. Records, Secretary's Office, Ford Motor Company; see Appendix for full table.

22. Parlin and Youker, *Report on Gasoline Cars*, MS.

23. Advertisement in *Harper's Weekly*, Feb. 1, 1913.

24. *Harper's Weekly*, Jan. 11, 1913.

25. Capital $2,000,000; surplus $20,673,500. Additional Tax Case, *Petitioners' Brief and Argument*, 215.
26. *Ibid.*, 104–105.
27. *Ibid.*, 215.
28. Additional Tax Case, *Petitioners' Statement of Facts*, 114.
29. Fiscal year ending September 30, 1913; *Petitioners' Statement of Facts*, 53.
30. Fiscal years ending Sept. 30, 1912, 1913; Records, Secretary's Office.
31. Additional Tax Case, *Petitioners' Statement of Facts*, 90.
32. *Ibid.*, 90–91.
33. Cf. Arnold and Faurote, *Ford Methods and the Ford Shops*, 47.
34. Records, Secretary's Office.
35. Parlin and Youker, *op. cit.*
36. R. T. Walker, *Reminiscences*, Ford Archives.
37. Max Wollering, George Brown, Joseph Galamb, *Reminiscences*.
38. Arnold and Faurote, *op. cit.*, 16.
39. Jan 8, 1910.
40. Clara Barrus, *Life and Letters of John Burroughs*, Boston and New York, 1925, II, 185–186, 191, 194.
41. Joseph Galamb, *Reminiscences*.
42. C. J. Smith, *Reminiscences*.
43. George Brown, *Reminiscences*.
44. Chicago Investigator No. 130, Report, Nov. 8, 1913, Accession 62, Box 4, Ford Archives.
45. R. T. Walker, *Reminiscences*.
46. Arnold and Faurote, *op. cit.*, 35–36.
47. *Ibid.*, 20.
48. Additional Tax Case, *Petitioners' Brief and Argument*, 136–137.
49. William S. Knudsen, interview with S. T. Miller, June 25, 1926, Additional Tax Case MSS., Accession 96, Ford Archives.
50. *Ibid.*
51. *Ibid.*
52. *Ibid.*
53. Jan. 6, 1911.
54. Arnold and Faurote, *op. cit.*, 116, 135–142. Facts in the following description of Ford's mass-production techniques are taken from this study.
55. This heavy volume, containing 440 pages, has hundreds of photographs and diagrams, and a preface by Charles Buxton Going.
56. N. A. Hawkins, *Ford Times*, VI, Sept., 1913, 486.
57. *Detroit Saturday Night*, V, July 15, 1911, 16.
58. Parlin and Youker, *op. cit.*
59. Additional Tax Case, MS. interview of A. J Lacey with C. C. Parlin, July 22, 1926; Accession 96, Ford Archives
60. Additional Tax Case, *Transcript of Hearings*, 1547–1560.
61. Washington, July 19, 1919; Accession 62, Box 89, Henry Ford Office File, Ford Archives. The demand for dealerships was as keen six years earlier.
62. L. E. Briggs, *Reminiscences of the Chicago Branch*, Ford Archives.
63. *Ford Times*, VII, April, 1914, 293.
64. *Ibid.*, June, 1914, 390.
65. *Ibid.*, VII, Aug. and Sept., 1914.

CHAPTER XX

The Five-Dollar Day (*Pages 512–541*)

1. Harold Underwood Faulkner, *The Decline of Laissez Faire, 1897–1917*, New York, 1951, 289–304.

2. Minutes of Automobile and Accessories Division of Employers' Association of Detroit (hereafter called E.A.D.), Jan. 3, 1911.

3. Minutes, Tenth Annual Meeting, E.A.D., Feb. 18, 1913, *passim*.

4. Chester M. Culver, "Detroit is Detroit Because of the Open Shop," pamphlet, 1928.

5. *Ibid.* Culver became general manager of the E.A.D.

6. Minutes, Fourth Annual Meeting, E.A.D., Feb. 19, 1907, 103.

7. "Detroit a Sanctuary in 1886 and Now," *The Detroiter*, Sept. 5, 1927, 19.

8. Minutes, Seventh Annual Meeting, E.A.D., Feb. 22, 1910, 199.

9. Minutes, Eighth Annual Meeting, E.A.D., Apr. 18, 1911, 214.

10. *Ibid.*, 22.

11. Minutes, Tenth Annual Meeting, E.A.D., Feb. 18, 1913, 314–315.

12. *Ibid.*, 315.

13. Minutes, Third Annual Meeting, E.A.D., Feb. 13, 1906, 83.

14. Minutes, Special Meeting of E.A.D., Jan. 16, 1912, 4–7.

15. Minutes, Seventh Annual Meeting, E.A.D., Feb. 22, 1910, 194.

16. Minutes, Special Meeting of E.A.D., Jan. 16, 1912, 5–6.

17. *Ibid.*, 18.

18. Faulkner, *op. cit.*, 277.

19. Minutes, Seventh Annual Meeting, E.A.D., Feb. 22, 1910, 222.

20. Minutes, Eighth Annual Meeting, E.A.D., Feb. 18, 1911, 222, 223, 228.

21. Minutes, Fifth Annual Meeting E.A.D., Feb. 18, 1908, 144.

22. Henry Faigin, *The Industrial Workers of the World in Detroit and Michigan*, MS., M.A. Thesis, Wayne University, 1937.

23. Cf. press reports on Studebaker strike, June, 1913; E.A.D. files.

24. Faigin, *op. cit.*, 74.

25. *Second Annual Report*, Michigan Department of Labor, 1911, 112–279.

26. "Pertinent Facts on Automobile Companies Prior to 1914," Accession 96, Ford Archives.

27. T. A. Mallon, C. J. Smith, Max Wollering, *Reminiscences*.

28. George Brown, *Reminiscences*.

29. Max Wollering, *Reminiscences*.

30. Fair Lane Papers, Box 126, Folder "Wages and Hours."

31. Work sheets from Accession 96, Folder "Ford Motor Company," Ford Archives.

32. *Ibid.*

33. T. A. Mallon, *Reminiscences*.

34. Max Wollering, *Reminiscences*.

35. *Twenty-second and Twenty-third Annual Reports*, Michigan Bureau of Labor and Industrial Statistics, Lansing, 1905, 1906.

36. G. B. Heliker, Interview with Chester M. Culver, Jan. 19, 1953; Special Collections of Columbia University Library.

37. John R. Lee, "So-called Profit Sharing System in the Ford Plant," *Annals of the American Academy of Political and Social Science*, LXV, May, 1916, 297–310.

38. *Ibid.*, 299.

39. Arnold and Faurote, *Ford Methods and the Ford Shops*, Ch. 16.

40. Detroit *Tribune*, Oct. 12, 1913.

41. *Ibid.*

42. Detroit *News*, Oct. 22, 1913.

43. Lee, *op. cit.*

44. Interview with Oscar C. Bornholdt, July 26, 1926, Additional Tax Case MSS., Accession 96, Box 2, Ford Archives.

45. Circular in Fair Lane Papers, Box 121; order effective Jan. 1, 1913.

46. Directors' Minutes, Dec. 22, 1905.

47. Directors' Minutes, Dec. 22, 1908.

48. Directors' Minutes, Dec. 18, Dec. 20, 1909.

49. Directors' Minutes, Nov. 24, 1911, Jan. 14, 1913.

50. Directors' Minutes, Nov. 20, Dec. 31, 1913.

[illegible] testimony before Judge Alschuler

[illegible]

[illegible]

[illegible] rd Archives.

[illegible] 1916, 272.

57. J. E. Mead, *op. cit.*, 7–8.

58. See Arnold and Faurote, *op. cit.*, 57, for reproduction.

59. Minutes of Executive Committee, Nov. 1, 1916, Accession 85–1, Ford Archives.

60. Arnold and Faurote, *op. cit.*, 41.

61. *Ibid.*, 61.

62. Minutes of Executive Committee, Nov. 1, 1916.

63. Lee to Boyd Fisher of Detroit Chamber of Commerce, June 24, 1914; Accession 62, Box 3, Ford Archives.

CHAPTER XXII

Rising Dangers (*Pages 568–587*)

1. Directors' Minutes, July 26, 1916.

2. Detroit *Evening News*, quoted in Dodge Suit Record, 371 ff.

3. C. C. Parlin and H. S. Youker, *Report on Gasoline Cars*, MS.

4. *My Life and Work*, 65.

5. *Ibid.*, 43.

6. Dodge Suit Record, 379, Ford's testimony.

7. Marquis, *Henry Ford: An Interpretation*, 180–181.

8. Minute Book (photostat in Ford Archives); Dodge Suit Record, 344.

9. Minute Book, Oct. 30, 1916 (photostat in Ford Archives).

10. Minute Book, *passim*.

11. Dodge Suit Record, 344.

12. *Ibid.*, 194 ff.

13. *Ibid.*, 200–201, 187 ff., 194 ff.

14. *Ibid.*, 190.

15. A. M. Wibel, *Reminiscences*, Ford Archives.

16. Dodge Suit Record, 374.

17. Marquis, *op. cit.*, 5.

18. Arnold and Faurote, *Ford Methods and the Ford Shops*, 20.

19. W. J. Cameron, *Reminiscences*.

20. *Ibid.*; Marquis, *op. cit.*, 8.

21. Cameron, *Reminiscences*. Ford's remark on fear is in *My Life and Work*, 249. His statements on thinking and "book-sickness" are in the little volume, *365 Sayings of Henry Ford*.

22. Dodge Suit Record, 374.

23. Cameron, *Reminiscences*. Ford's ideas on money, work, and charity are given at length in *My Life and Work*, in Rose Wilder Lane, *Henry Ford's Own Story*, New York, 1917, and in Benson, *The New Henry Ford*.

24. Cameron, *Reminiscences*. Lane, *op. cit.*, 23, quotes Ford's remark about never knowing what to do with money.

25. Marquis, *op. cit.*, 48.

26. Cameron, *Reminiscences*.

27. *Ibid.*

28. *Ibid.*; but whether Knudsen ever made such a statement is uncertain. Many critics, including Dr. Marquis, *op. cit.*, and Arthur Pound in "The Ford Myth," *Atlantic Monthly*, CXXXIII, Jan., 1924, 44, have noted that Ford was less generous in giving credit to his associates than they to him.

29. Marquis, *op. cit.*, 19–20. See also Louis P. Lochner, *Henry Ford—America's Don Quixote*, New York, 1925, *passim*.

30. Gamaliel Bradford, *The Quick and the Dead*, Boston, 1931, 134.
31. Marquis, *op. cit.*, 152–153.
32. Cameron, *Reminiscences.*
33. Marquis, *op. cit.*, 78–79.
34. Simonds, [illegible], *Reminiscences*, Ford Archives.

[illegible] agazine), Nov. 5, 1911.

38. Marquis, *op. cit.*, 37.
39. Detroit *News-Tribune*, July 13, 1919
40. Detroit *Journal*, July 16, 1913.
41. Fair Lane Fact Sheet, Ford Archives
42. Marquis, *op. cit.*, 169.

APPENDIX II

HENRY FORD'S PARENTS[*]

With Some Details About the Litogot Family and the Ford and Scotch Settlements

William Ford's first ten years in Michigan were strongly influenced by his family: his grandmother, Rebecca Jennings Ford (1776–1851), his father John Ford, and his six brothers and sisters. When William sailed from Ireland in 1847 with these eight, together with his mother Thomasina Smith Ford, he was his father's chief helper, for he was the oldest of the three sons, being 21 years of age, while Henry was 17 and Samuel only 10. His sister Rebecca was a year older than William; of the other girls Jane was 18, Mary 15, and Nancy 13.

In addition to being the oldest son, William was apparently responsible by nature in a situation that called for responsibility. With his mother dying at sea or just after the arrival in Canada, with his grandmother 71 and called upon to make an adjustment to a strange land, with his father feeling the loss of his wife, worried about his brood of children, and facing financial difficulties, every effort was needed to establish the new home on a sound and happy basis. William gave vigorous help both in clearing the land and building a house, and later in working for the Michigan Central to provide the ready money the family badly needed.

Henry, the next brother, was able to do a man's work when he arrived in Michigan, but he seems to have been less stable than William. Apparently he too worked on the railroad for a time, and doubtless did his share on the farm, but he disliked the cold Michigan climate, as his letter to William quoted in Chapter III indicates, and was attracted by the news of the gold strike on the Pacific Coast. "Henry left RR in 1851 for the goldfields of California," wrote Marvin Buckberry in the 1920's on the time chart he prepared for his projected life of Henry Ford the industrialist, and this single brief entry indicates the younger brother's restlessness, as well as the renewed necessity for William to assist his father after Henry left, for the latter did not return from California with gold, but remained there, marrying Katherine O'Leary in San Francisco in 1857 and rearing eight children on the Pacific Coast. William would be tied to the family in Dearborn until Samuel was grown. The latter was eighteen in 1855, and apparently began to take over

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[*] This account is based upon the genealogical material in the Ford Archives, upon Mrs. Margaret Ford Ruddiman's reminiscences, Clyde Ford's memoir, early accounts and records of the Dearborn area—all cited elsewhere in this volume—and on such Litogot materials as the Archives contain.

some of William's responsibilities. In 1858 John sold the farm to the two sons, each paying the modest price of $600 for 40 acres. This fact indicates that Samuel had done his share and was judged to be deserving of a reward.

At the age of 32, William was now free to strike out for himself. His grandmother had died some years earlier; Rebecca, Jane and Nancy were married; his sister Mary, still single, was presumably acting as housekeeper for John. In 1861 she herself took a husband—her first cousin Henry, a son of John's brother Samuel. It may be assumed that her father made his home with her, her husband and his six children—a large family soon to be augmented by the four additional children which Mary herself bore. (See Appendix I for Henry and his children.) Mary and her husband by purchases in 1867 and 1868 acquired the entire 80 acres of the original farm. (Samuel sold his 40 acres to them in 1867, and Jacob Esper, who had purchased William's 40, disposed of it to Henry the following year.)

William's earlier life in Michigan should be thought of in connection with the Ford Settlement and the Scotch Settlement. The two groups were territorially contiguous. The Fords occupied farms near the conjunction of Dearborn, Redford, Springwells, and Greenfield townships—that is, they had settled the northeastern corner of Dearborn, acquired some acreage just north across the line in Redford, and held a considerable acreage in the southwestern corner of Greenfield. John Ford as we have seen held land in Redford about two miles west of where that township and Greenfield touched. The Scotch settlement lay just south of the Ford Settlement, covering about the same range of land from east to west, but with its larger number of farmers making a much deeper area from north to south.

It had been started several years before the Ford Settlement. Its first members seem to have been the Gardners, Stevensons and Robertsons; later, about the same time as the first Fords arrived, came the Ruddimans, Rycrafts, Leslies, Gaulds, Grays, Wards, Forsyths, Lorimers, Joneses, McCormicks, Nobles, Campbells, Cockburns and Troups. The largest group of families were of Scottish derivation, but others were English, Scotch-Irish and Irish. The Scottish flavor was dominant: industry and sobriety tinged with a strong regard for learning. By 1839 the settlement, which from the start had maintained school in the homes of its members, had erected a schoolhouse constructed of boards finished at George Troup's mill, and had established a library administered by old William Leslie at his home. Charles Ward wrote letters to the *Michigan Farmer* in which he quoted *Hamlet* and used Latin terms with facility. To the Scotch Settlement came itinerant preachers to deliver sermons—one, Elder Morel, in 1845, arriving it was said in the first buggy ever to invade the community.

The Fords lacked the keen interest in books and learning which characterized their neighbors to the south, but were appreciative of the school

and the library. They were ingenious mechanically and progressive in farming methods; they served as overseers of highways and "pathmasters" for their road districts, helped organize churches, and established a cemetery for members of their own families. This dated back to the 1840's—probably to Samuel's death in 1842 or earlier—but the plot seems to have been administered for decades in an informal way, and it was not until George Ford and his wife Mary L. conveyed a tract of land on Joy Road between Greenfield and Southfield to three trustees in the year 1893 that the Ford Cemetery was legally established. It was reserved for the use of the families of Samuel, George and John Ford, and their descendants.

Up to 1858 William Ford had lived in Redford and his associations had been chiefly with his own relatives. As he began to work for and with Patrick O'Hern, he soon acquired land to the southeast of his former home, partly in Dearborn and partly in Springwells. Actually it was at the southwest corner of the Scotch Settlement, and while he maintained friendly relationships with h[illegible] with the Scotch Settlement families. [illegible] cousin, Samuel's son, was called William North.

William had of course been educated in Ireland, wrote a fair letter (a few survive in the Ford Archives) and according to his daughter Margaret was a diligent reader, particularly of newspapers; he showed a firm religious bent and was fond of discussing public events and policies. When Henry Ford the industrialist was a boy, William used to meet regularly with his neighbors Horger and McCormick for this purpose. From an early date (although after his marriage) he was a member of the school boards both for the district in which the Scotch Settlement School lay in Dearborn, and for that of the Miller School in Springwells. (His land and even his house lay partly in each of these districts.) According to Margaret Ford Ruddiman he interviewed prospective teachers for each district, and sometimes sent his children to a school because he felt that the instruction there would be superior to that in the other.

In the late 1850's William had probably assumed no duties as a local official, but his general character had been formed, and doubtless one reason he was attracted to Mary O'Hern was that he perceived kindred characteristics in her. She was responsible, religious, interested in reading (as Henry Ford later remembered), and a diligent worker. That she was livelier than William and showed a quiet sense of humor would not have lessened his liking for her.

Mary Litogot seems to have been adopted by the O'Herns when she was [illegible] community [illegible] oldest, Sapharia (also spelled Sophira and Saphira [illegible]

"Saffarius," as Mrs. Ruddiman says the family called him) was eight or nine; Barney was a year older than Mary and John a year younger. An unsigned manuscript in the Ford Archives, "The Boy Henry Ford," the work of Ann Hood, who as a high school girl submitted a number of questions to Henry Ford with the hope of writing about him, states that the O'Herns learned of Mary's being orphaned through two Detroiters—Sylvester Larned, a lawyer, and Senator Thomas Palmer. Mrs. Ruddiman believed that Mrs. Flowers (born Hanna) knew both the Litogots and the O'Herns, and helped arrange for the adoption. All may have had a part in bringing it about. Doubtless friends or relatives in Wyandotte took care of the other Litogot children.

Mary attended the Scotch Settlement School, sharing a seat with Ann Leslie. She studied the Sander readers, which combined common sense with moral and religious instruction. Some of the lessons she studied were entitled "The Way to Become Wise," "The Love of God," and "Read and You Will Know." Poetry was abundantly represented, and it too was moral and instructive in tone. One selection, "My Bible," began

My Bible! 'Tis a book divine
Where heavenly truth and mercy shine,

and another, "The Post-Boy," shows a friendly but firm purpose to strengthen character while imparting information. In part it runs:

Take Care! my post-boy, not so fast,
For if your steed should fail
Upon the road, you'll find at last,
You needs must leave the mail.

"O no, indeed!" his quick reply,
"Nor need you think it strange,
For though ten miles I swiftly fly,
I then my horse exchange;

"And with another fresh and fleet,
Still hasten on my way,
Nor even stop, my friends to greet,
Lest I the mail delay."

Mary took her schooling with a serious diligence, doubtless getting both tutorial assistance and philosophic guidance from Margaret O'Hern. She adopted her mother's Episcopal religion, another point in common with William Ford.

Although calling herself Mary O'Hern, and happy with her foster parents, Henry Ford's mother seems to have kept in touch with her brothers. She was apparently the pronounced brunette of the family—the dark Flemish

type. John in his pictures appears to have been of medium coloring, and Barney was quite fair. No picture survives of Sapharia, but his children were light rather than dark.

Sapharia became a carpenter like his father, and pictures survive of at least one house that he built. In the early 1850's he married Lethera Brown, by whom he had at least three children. Unfortunately he lost his wife in 1867 to Andrew Threadgould, the same man who paid John $1000 to act as his substitute in the war.

Barney was married in 1861 to a young woman whose given names were Caroline Amelia; after emerging safely from the war, he became the father of four children, apparently working for a time as a lighthouse keeper. He and Sapharia both remained in or near Wyandotte, Barney dying in 1873 and Sapharia in 1878. The Litogots still kept in touch with Mary Ford; Margaret Ford Ruddiman recalled that Sapharia's son Abner came to her mother's funeral. If William Litogot was Dutch or Belgian by birth, his children seem to have been fully American. Perhaps their mother was of British descent. All married men or women of British names so far as these are known. A group came to visit Henry Ford in 1930, doubtless at his invitation, and were photographed with him and with Edsel's two boys, Henry and Benson. Some of the birth dates written on the back of a group picture fix the year definitely. Doubtless as a result of this visit, Henry acquired two albums of Litogot photographs, which contain pencilled notes in his handwriting. These are the chief sources of information about the family. A correspondence conducted by Ford officials with some persons named Titeca (Liteca is given as a variant) in Belgium indicate that there was uncertainty as to whether William Litogot or his parents had come from that country or from Holland (the land usually named). The Titecas could prove no connection with Mary's parents in America, although they had apparently been attracted by the name Ford and the hope to profit financially, and sought to establish a relationship.

Mary's life with William Ford was a happy one. He loved her deeply, and respected her judgment and force of character. After her death he often referred to her opinions and standards of conduct, using these to guide his children. "Your mother would have wanted you to do this," was a frequent statement from which there was no appeal.

After Margaret O'Hern's death in 1870 Patrick, now in his late sixties, seems to have left the farm work increasingly to William; Mrs. Ruddiman recalled that he did chores about the house and yard. He was devoted to the memory of his wife. Although she seems to have been at least twelve and perhaps eighteen years older than he, she made him happy. Doubtless she was mother to him as well as wife, and was a helpful business adviser. While Margaret Ford *could not* remember Mrs. O'Hern, she recalled that Patrick

kept all her clothing as it had been when she was alive. He himself died in 1882 and was buried in the graveyard of the Roman Catholic St. Alphonse's Church, Detroit.

APPENDIX III

TOTAL SALES OF FORD CARS

(From the Secretary's annual reports for 1903–1904 and 1904–1905, and the Special Data File of the Ford Motor Company)

Cars Sold:

1903–4	1,700	
1904–5	1,745	
1905–6	1,599	
1906–7	8,423	
1907–8	6,398	
1908–9	10,607	
1909–10	18,664	
1910–11	34,528	
1911–12	78,440	
1912–13	168,304	
1913–14	248,307	
1914–15	221,805	(10 mo.)
1915–16	472,350	
1916–17	730,041	
1917–18	656,165	
1918–19	487,802	
1919–20	635,226	Aug. 1919 to Apr. 1920
1919–20	690,755	May 1920 to Dec. 1920
1920–21	933,720	
	5,406,584	

Tractors sold to Jan. 1, 1922:	199,447

APPENDIX IV

DOLLAR SALES OF FORD CARS

(From Secretary's reports, Ford Motor Company, and other special sources)

Fiscal Period Ending	*Amount*
Sept. 30, 1903	$ 142,481.72
Sept. 30, 1904	1,162,815.87
Sept. 30, 1905	1,901,102.82
Sept. 30, 1906	1,491,626.16
Sept. 30, 1907	5,773,851.38
Sept. 30, 1908	4,701,298.42
Sept. 30, 1909	9,041,290.55
Sept. 30, 1910	16,711,299.45
Sept. 30, 1911	24,656,767.75
Sept. 30, 1912	42,477,677.22
Sept. 30, 1913	89,108,884.56
Sept. 30, 1914	119,489,316.99
July 31, 1915	121,130,859.63
July 31, 1916	206,867,327.46
July 31, 1917	274,575,051.53
July 31, 1918	308,719,033.60
July 31, 1919	305,637,115.28
Apr. 30, 1920	429,866,662.65
Dec. 31, 1920	483,896,482.65
Dec. 31, 1921	546,049,449.96
	$2,993,400,395.65

APPENDIX V

PRICES OF FORD CARS

(From the files of the *Ford Times*)

1903–1904	*Model A*	Runabout	$ 850.00	Tonneau	$ 950.00
1904–1905	*Model B*	Touring	2,000.00		
1904–1905	*Model C*	Runabout	900.00	Tonneau	1,000.00
1904–1905	*Model F*	Touring	1,000.00		
1905–1906	*Model B*	Touring	2,000.00		
1905–1906	*Model F*	Touring	1,000.00		
1906–1907	*Model N*	Runabout	600.00		
1906–1907	*Model R*	Runabout	750.00		
1906–1907	*Model S*	Runabout	700.00	Roadster	750.00

1907–1908

October 1, 1907 to September 30, 1908

Model K
Roadster, $2,800.00; Touring, $2.800.00.

Model T
October 1, 1908 Touring Car, $850.00; Town Car, $1,000.00; Roadster, $825.00; Coupe, $950.00; Landaulet, $950.00.

Model R
1909—to Oct. 1 Runabout, $750.00.

Model S
Runabout, $700.00; Roadster, $750.00.

Model T
October 1, 1909 Touring Car, $950.00; Tourabout, $950.00; Roadster, $900.00; Coupe, $1,050.00; Landaulet, $1,100.00; Town Car, $1,200.00.

Model T
October 1, 1910 Roadster, $680.00; Tourabout, $725.00; Touring, $780.00; Coupe, $840.00; Town Car, $960.00; Landaulet, $1,100.00.

Model T
October 1, 1911 Torpedo Runabout, $590.00;* Commercial Roadster, $590.00; Touring Car, $690.00; Delivery Car, $700.00; Town Car, $900.00.

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* Introduced November, 1911, and discontinued before Oct. 1, 1912.

Model T

October 1, 1912 Runabout, $525.00; Touring, $600.00; Town Car, $800.00; Delivery Wagon, $625.00.

Model T

August 1, 1913 Runabout, $500.00; Touring, $550.00; Town Car, $750.00.

Model T

August 1, 1914 Runabout, $440.00; Touring, $490.00; Town Car, $690.00.

Model T

August 1, 1915 Runabout, $390.00; Touring, $440.00; Couplet, $590.00;* Sedan, $740.00;† Town Car, $640.00; Chassis, $360.00.

Model T

August 1, 1916 Runabout, $345.00; Touring, $360.00; Couplet, $505.00; Sedan, $645.00; Town Car, $595.00; Chassis, $325.00.

APPENDIX VI

NET INCOME OF FORD MOTOR COMPANY

(From Martindale Papers, Ford Motor Company Archives)

June 16, 1903—Sept. 30, 1903	$ 36,957.64
Oct. 1, 1903—Sept. 30, 1904	246,079.67
Oct. 1, 1904—Sept. 30, 1905	289,232.20
Oct. 1, 1905—Sept. 30, 1906	116,084.70
Oct. 1, 1906—Sept. 30, 1907	1,163,184.73
Oct. 1, 1907—Dec. 31, 1908	1,145,392.48
Calendar Year 1909	3,062,352.01
" " 1910	4,163,451.26
" " 1911	7,338,587.50
" " 1912	13,542,678.28
" " 1913	27,087,203.52
Nine months to Sept. 30, 1914	24,698,079.91
Ten months to July 31, 1915	23,532,297.60
Fiscal year to " 31, 1916	57,157,216.06
" " " " 31, 1917	27,288,042.83
" " " " 31, 1918	30,942,123.74
Five months to Dec. 31, 1918	11,662,159.49
Calendar Year 1919	69,924,410.52
" " 1920	53,448,479.82
" " 1921	75,890,836.44

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* Introduced November, 1915.

APPENDIX VII

AVERAGE NUMBER OF EMPLOYEES ON ROLLS OF FORD MOTOR COMPANY AT HOME PLANT

(Papers in evidence, Additional Tax Case)

Year	*Average for year*	
1903	125	Estimated by Messrs. Hartner, Degener & Wandersee
1904	300	
1905	300	
1906	700	
1907	575	
1908	450	
1909	1,655	
1910	2,773	
1911	3,976	
1912	6,867	
1913	14,366	
1914	12,880	
1915	18,892	
1916	32,702	
1917	36,411	
1918	33,699	
1919	44,569	
1920	51,197	
1921	32,679	
	295,116	

Average for entire 19 yrs.—15,532

APPENDIX VIII

DIVIDENDS PAID FROM START OF COMPANY TO JANUARY 1, 1916

(Papers in evidence, Additional Tax Case)

Nov. 21, 1903	10,000.00
Jan. 8, 1904	20,000.00
June 16, 1904	68,000.00
June 16, 1905	100,000.00
July 24, 1905	100,000.00
Oct. 24, 1906	10,000.00
Nov. 13, 1907	100,000.00
Apr. 30, 1908	100,000.00
May 22, 1908	100,000.00
June 20, 1908	100,000.00
July 28, 1908	100,000.00
Oct. 1, 1908	100,000.00
Nov. 25, 1908	100,000.00
Nov. 30, 1908	1,900,000.00—Stock Payment
Jan. 25, 1909	100,000.00
Mar. 17, 1909	100,000.00
Apr. 30, 1909	100,000.00
May 24, 1909	100,000.00
June 16, 1909	100,000.00
June 26, 1909	100,000.00
July 21, 1909	100,000.00
July 28, 1909	600,000.00
Aug. 25, 1909	89,000.00
Aug. 31, 1909	11,000.00
Sept. 24, 1909	100,000.00
Oct. 18, 1909	300,000.00
May 17, 1910	700,000.00
June 25, 1910	1,000,000.00
Sept. 8, 1910	300,000.00
Feb. 21, 1911	5,000.00
April 29, 1911	800,000.00

July 1, 1911	300,000.00
Aug. 1, 1911	600,000.00
Oct. 2, 1911	300,000.00
Dec. 13, 1911	800,000.00
Dec. 31, 1911	200,000.00
Jan. 2, 1912	300,000.00
Apr. 1, 1912	300,000.00
May 15, 1912	2,000,000.00
July 1, 1912	300,000.00
July 11, 1912	2,000,000.00
Oct. 1, 1912	300,000.00
Jan. 2, 1913	300,000.00
Apr. 1, 1913	300,000.00
June 16, 1913	10,000,000.00
July 1, 1913	300,000.00
Oct. 1, 1913	300,000.00
Jan. 1, 1914	300,000.00
Apr. 1, 1914	300,000.00
May 14, 1914	600,000.00
May 29, 1914	1,400,000.00
June 12, 1914	2,000,000.00
July 1, 1914	300,000.00
July 16, 1914	2,000,000.00
July 23, 1914	2,000,000.00
Oct. 1, 1914	300,000.00
Oct. 23, 1914	3,000,000.00
Jan. 2, 1915	300,000.00
Apr. 1, 1915	300,000.00
May 28, 1915	10,000,000.00
July 1, 1915	300,000.00
Oct. 1, 1915	300,000.00
Oct. 13, 1915	5,000,000.00

APPENDIX IX

MANUFACTURING COSTS, 1913

(Parlin and Youker Report 1913)

(This is simply a "rough estimate," no valid figures being available; but it it is based on a very careful investigation):

	Ford Grade	*$1,000 Grade*	*$2,000 Grade*	*$4,000 Grade*
Material, Labor	$340; 62%	$550; 55%	$1,050; 52.5%	$1,900; 47%
Advertising, Selling, and Overhead	20; 4	100; 10	250; 12.5	550; 14
Wholesale and Retail selling costs	90; 16	250; 25	500; 25	1,200; 30
Manufacturers Profit	100; 18	100; 10	200; 10	350; 9
Cost [illegible] Consumer	550	1,000	2,000	4,000

APPENDIX X

BRANCHES AND MARKETING

Distribution methods in the automobile industry were divided between marketing through distributors throughout the country and marketing through one's own branches and assembly plants. The policy of the Ford Motor Company, established early in its history, was to distribute through branch houses and assembly plants, under which were dealers and subdealers. The branch house system enabled the company to control prices and service throughout the country. This was important because of the volume of the company's business and because of the service required on the Ford car.

Branch house plans were made for practically every important city in the country. They were located at freight rate breaking points so as to reduce shipment costs. Branch houses existent in March, 1913, were:

American:

- Atlanta
- Boston
- Buffalo
- Cambridge
- Charlotte, N. C.
- Chicago
- Cincinnati
- Cleveland
- Columbus
- Dallas
- Denver
- Detroit
- Fargo
- Houston
- Indianapolis
- Kansas City
- Long Island City
- Los Angeles
- Louisville
- Memphis
- Minneapolis
- New York
- Oklahoma City
- Omaha
- Philadelphia
- Pittsburgh
- Portland, Oregon
- St. Louis
- St. Paul
- San Francisco
- Seattle

Foreign:

- Calgary, Alta.
- Hamburg, Germany
- Hamilton, Ont.
- London, Eng.
- London, Ont.
- Manchester, Eng.
- Melbourne, Aust.
- Montreal, Que.
- Paris, France
- Saskatoon, Sask.
- Toronto, Ont.
- Vancouver, B. C.
- Walkerville, Ont.
- Winnipeg, Man.

Total sales of company, branch sales, and ratio of branch sales:

Fiscal Period	*Total Sales*	*Branch Sales*	*Percentage*
Sept. 30, 1909	$ 9,041,290.55	$ 5,628,024.53	62.2%
“ “ 1910	16,711,299.45	11,181,998.88	66.9
“ “ 1911	24,656,767.75	17,111,888.87	69.4
“ “ 1912	42,477,677.22	30,888,135.05	72.7
“ “ 1913	89,108,884.56	70,251,786.78	78.8
“ “ 1914	119,489,316.99	95,124,724.67	79.6
July 31, 1915	121,130,859.63	104,622,232.68	86.4
“ “ 1916	206,867,327.46	181,628,851.43	87.8

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Ford: the Times, the Man, the Company is the first volume dealing with Henry Ford and his associates for which it has been possible to utilize extensively both the varied materials formerly in the possession of the Ford family and the comprehensive records of the Ford Motor Company. Aided by a research staff which usually numbered three persons, the author has also fortunately been able to explore other important sources of information, some only recently accessible, and the total so voluminous that no previous writer in the field has been able to study [illegible] ion engine, [illegible] in Europe and America, the early progress of American automobile manufacturing, and such no[illegible] M[illegible] du[illegible] the volume.

The follow[illegible] writing of the [illegible] ous that lack [illegible] value. However, [illegible] ng the notes for the separate chapters, or in those at the foot of various pages of the text. The notes in their entirety really comprise an extensive bibliography, and the more formal listing which follows this introductory note adds only some pertinent comments on the character of special materials, and a type of arrangement which will be more convenient for any who seek particular items of information or wish to carry on research in the field covered by the book, or in others closely related to it.

I. THE FORD MOTOR COMPANY ARCHIVES, FAIR LANE, DEARBORN

In February, 1951, the Ford Motor Company established a company archives now housed in the Dearborn home of Henry Ford. Despite its relatively recent organization, this collection unquestionably occupies the first rank among American industrial archives. Historians and other researchers, especially those interested in business history, will find at Fair Lane a mine of printed and documentary materials of every description illuminating the corporate activities of the company and the many-sided career of Henry Ford. The holdings, as varied as they are extensive, include personal and business correspondence, production, sales, and financial records, company minute books, legal documents and records, diaries and memoranda, books, clippings, pamphlets, and periodicals, and photographs

and blueprints. These comprise a massive [illegible]

[illegible]

E. Edmunds. [illegible] taking the coll[illegible] preservation of its permanent records on such a scale might well serve as a model for other large industrial corporations conscious of their obligations to the documented past. (For a preliminary description of the Archives, see Henry E. Edmunds, "The Ford Motor Company Archives," *The American Archivist*, XV, April, 1952, pp. 99–104.)

In March, 1953, the steadily growing collections of the Archives consisted of 297 separate accessions totaling 4657 linear feet of boxed records. These holdings are grouped in two broad divisions:

(1) The Fair Lane Collection, containing the records of Henry and Clara Bryant Ford found in the Fair Lane residence after Mrs. Ford's death. These records, arr[illegible] ily, social, and bus[illegible]

(2) The records of th[illegible] These comprise th[illegible]

Among the more important accessions used in the preparation of this volume are:

Selected Documents.
Fair Lane Papers. (Accession 1).
Henry Ford Office—Correspondence. Accession 2.
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An essential and *invaluable* part of the permanent records are the memoirs compiled from tape recorded interviews by the Oral History Section of the Archives. This project is unique among the present operations of American industrial archives. The Oral History Section, under the direction of Mr. Owen Bombard, a trained [illegible] the recollections [illegible] the Ford Motor [illegible] packed with inti[illegible] detail, are of inestimable aid to the historian in

certain areas of the past where contemporary documentation is sparse or completely lacking. By March, 1953, the Oral History Section had conducted 386 interviews with 196 persons, and had processed 17,500 pages of transcript. Among the memoirs used intensively in the preparation of this volume are those based on interviews with the following persons:

Oliver E. Barthel, David M. Bell, C. H. Bennett, Frank Bennett, George Brown, Charles T. Bush, W. J. Cameron, Joseph Galamb, William C. Klann, Ernest G. Liebold, Artemas L. Litigot, T. A. Mallon, Lord Percival Perry, William Pioch, William W. Pring, Fred Rockelman, Edsel Ruddiman, Margaret Ford Ruddiman, Louis C. Scott, Nettie Bryant (Mrs. Louis C.) Scott, Fred W. Seeman, Claude Sintz, C. J. Smith, Clara Snow, Charles E. Sorensen, R. T. Walker, E. Walters, A. M. Wibel, John Wandersee, and Max Wollering.

The Ford Archives has also acquired a number of written memoirs, among them those of Irving R. Bacon, L. E. Briggs, Clyde Ford, C. H. Holley, and Margaret Ford Ruddiman. Bacon is an artist who worked a number of years for the Ford Motor Company; Briggs's experience was with the Chicago branch of the Company; Clyde Ford was a relative of Henry Ford whose account of early pioneer days in the Dearborn area and the Ford family in that period is particularly valuable; Holley was an inventor and employee of the Company; and Mrs. Ruddiman, [redacted] Henry Ford's sister, has contributed details in her written memoir which do not appear in her *Reminiscences*, based on tape-recorded interviews.

Other

Anderson

J. W. Anc

II. THE DETROIT PUBLIC LIBRARY AND THE UNIVERSITY OF MICHIGAN

At the Detroit Public Library are two notable groups of materials:

A. The Automotive History Collection. Besides a wealth of general material of various types, including one of the best files of automotive trade periodicals to be found in the country, this collection contains the following important units:

The David Beecroft Papers: letters, statements, pamphlets, books and other items valuable for the light they throw on the origins and early history of the American automotive industry.

The Charles B. King Papers: a voluminous assortment of letters, sketches, interviews, pictures, King's diary, and other items bearing on early automotive history and to no small extent on Henry Ford.

The Ralzemond A. Parker Papers: letters and other materials relating to Parker's activities as counsel for the Ford Motor Company and other defendant firms in the Selden patent suit, and for firms opposing the patent in other actions.

B. The Burton Historical Collection. A basic and indispensable source for Detroit History. Among its holdings are files of local newspapers and periodicals; scrapbooks compiled by Clarence M. Burton, C. I. Walker, William Stocking, Friend Palmer, and other Detroit residents interested in local

history, and interviews and manuscripts, among the latter Frank Leslie Stevenson's "Scotch Settlement."

At the University of Michigan, Ann Arbor, Michigan, the following collections bear upon the early development of the automobile industry:

The Roy D. Chapin Papers:
The Henry B. Joy Papers:
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For articles from these and other newspapers and magazines, see notes for separate chapters.

INDEX